Canada. Parliament. Senate. Special Committee on Science policy

Digest of the Proceedings of the Senate Committee on Science Policy

DIGEST OF THE PROCEEDINGS OF THE SENATE COMMITTEE ON SCIENCE POLICY

First of Four Parts - (Reports No. 1 - 12)

No. 1 - October 9th, 1968

Witness: M.W. Mackenzie, Chairman, Royal Commission on Security

He urged a general incentive plan to encourage research and development apart from any devised to promote projects. His six points on the role of government in research were:

1. Research is only a small part of the total innovation process.
2. There is a pressing need to develop priorities.
3. Industrial research merits a general incentive plan.
4. Industrial research is dependent on decentralized decision-making; tax incentives provide the most effective scheme for encouraging such decision-making.
5. We should accept and not be afraid of the international implications of research.
6. Concentration on centres of excellence is the best defence against the brain drain.

It is only when results are translated into better products and things, or better ways of producing things that the real benefits are felt. In framing a national science policy, it must be borne in mind that it takes much more than a research effort.

The path between an invention and the market place was hazardous and costly. 1967 U.S. Department of Commerce study showed R & D comprised between 5 and 10 per cent of the total cost of bringing in a new product.

Once the basic work was done further development had to be toward some economically viable objective, and the carrying through of that stage is the really expensive part of the process. It was also the stage which called for priorities--balancing expected costs against expected return.

Setting priorities was tremendously difficult. Managerial judgment was important if we are to get real value from our research efforts.

There is a need for a continuing body of independent government advisors drawn from those with established expertise.

He made a case for a general incentive plan because general social gains in research far exceed those likely to accrue to the individual firm, and the risks to the private investor were greater than the risks to society. Left to itself the market would allocate too few resources to research in general, and would also tend to bias the allocation against scientific research as contrasted with applied scientific research.

He questioned the nationalistic implications of the April, 1965 research plan which required prior approval of the project on grounds it would be likely to benefit Canada.

With the tremendous development of international companies and the hugh reservoir of technical knowledge they had, Canada defeated its own ends if in our R & D policy we discriminate against them as compared to purely Canadian companies.

No. 2 - October 9th, 1968

Witness: J. Spaey, Secretary-General, National Scientific Policy Council, Belgium.

He dealt with some of the social implications of science policy, and the role of government in stimulating research. He referred to the springing up of political science institutes in the majority of industrialized countries in recent years to organize the development of science to attain certain national objectives. Making forecasts and establishing goals was a particularly difficult type of problem which calls for establishment of special organizations to handle them.

.../2

No. 3 - October 23rd, 1968
Witness: National Research Council (W.G. Schneider, President, et al)

The splitting of pure and applied science, and separation of such functions as industrial research from the National Research Council would be a serious mistake.

The effectiveness of the council in the past had been due in large measure to the close working contact it has established with the scientific community, and to the confidence it has engendered by practising high quality science in its own laboratories.

At a time when major research projects require an interdisciplinary approach and also co-ordination of co-operative programs with university, industry and government laboratories, excessive fragmentation of agencies would be a serious handicap.

While great strides had been made in scientific development in the past two decades, our present development with respect to the application and utilization of science is alarmingly unbalanced.

Reasons for this were complex. Industrial R & D had concentrated on short-range programs concerned with minor extension of existing technology rather than with development of new technology. Longer range programs to develop new technology required a lead time of five to ten years, and economic return might not come until 10 or 20 years later.

Canada must take a greater committment to new technology. By being selective we can become pre-eminent in those areas where we have a favorable base or special advantage. These areas should be identified and given special support. Such areas included transportation, telecommunications, building materials and building technology, environmental pollution, metal physics, metallurgy, marine sciences, food technology, energy and power technology, northern development and specialized computer technology.

To exploit and assimilate new scientific knowledge it was essential to have ready access to the rapidly expanding world-wide information pool. The council will soon increase greatly the extent of its information services.

There is a need to develop greater depth and concentration in important selected areas, provide for special research facilities, and foster more inter-disciplinary research. Closer interaction and collaboration between university laboratories, government laboratories and industrial laboratories was urged.

National policy should concern itself with such areas as conservation, pollution and other environmental problems, housing and urban problems, fire protection, law enforcement, public health and public safety.

National science policy should pay urgent attention to regional disparities to promote resource and industrial development.

Science could play an important role in national units and inter-cultural relationships. Major research laboratories should be established in which French is the working language. Exchange programs between francophone and anglophone universities should also be encouraged.

A national science policy should also take account of programs and goals of provincial governments and promote co-operation and co-ordination of research programs.

The two main aspects to science policy were: policy for science proper, concerned with developing a favorable climate for a strong indigenous science; and policies concerned with mobilizing and applying scientific resources towards national goals.

.../3

While a number of universities have built up strong graduate schools, a number of branches of the main disciplines are still weak. Examples are molecular biology, inorganic chemistry, theoretical physics and chemistry, solid state physics, and biophysics.

Some very promising research groups were developing in the newer fields of space sciences, radio astronomy and in computer sciences. But the applied sciences are not as yet as highly developed as the pure science disciplines, largely because research in engineering schools is expensive, cannot flourish without a favorable industrial climate, and had a much later start.

Attention was drawn to the disproportionate development of scientific research and advanced technology in Canadian industry. Economic factors such as the size of markets were part of the reason, but in the face of a rapid university expansion, industrial laboratories have not competed successfully for their share of top scientific and engineering talent.

Dealing with research manpower, a N.R.C. study showed the picture of a continuing shortage was likely to change rapidly. Annual output of new Ph.D's had increased from over 200 in 1959 to a projection of around 2,000 in 1973. Annual number of new positions had increased from over 400 to nearly 1,000 and was not expected to rise greatly beyond this figure.

The rapid rise over the past 10 years in Ph.D. employment was directly related to rapid university expansion. It was likely that universities would continue to employ the largest number of new graduates. Government would likely be taking slightly increasing numbers, and an increasing demand did not appear likely from the industrial sector.

In many disciplines shortages might be expected to extend well into the 1970's. And these projections assumed there would be no major new government-sponsored programs in the next few years.

The N.R.C. had not carried out research exclusively in the pure sciences. It had done much research on the applied side.

Decisions had to be made on how much money should be put into basic research and how much into applied research. The big problem was to decide which was the best way to promote and encourage industrial R & D and more industrial innovation.

Time and time again it had been shown there was no use in doing a lot of industrial type research in government laboratories if the industries are not there to take it up and exploit it. It is not so much a matter of what we spend in fundamental research and applied research but rather how we can get some of this activity into industrial laboratories, to be undertaken by industry.

I think certainly if what we call indigeneous science were put under a minister of technology it would not come off too well.

We require some kind of central focus within government at Cabinet level, where decision-making can be focussed; and it also means they would require probably a committee or one man who would require some research help.

The N.R.C. has a group headed by "delegué général" whose sole function was to analyze ongoing projects to try to project them into the future, and decide whether the program was getting anywhere. The same approach was taken to some of the longer term projects.

As illustrations of N.R.C. assistance and facilities was the special emission spectroscope specialized analog computers, numerical analysis, special analysis. Then there were the techniques that enabled a process to become commercial, such as the fluidized-bed technique, and spherical agglomeration being developed.

Ten years ago the building research division was approached with the question: how

.../4

should snow loads on roofs be calculated? Sixty-six actual sites were selected and at the end of five years it was established that empirical equations in use were grossly exaggerated --some of them by as much as 20 to 25 per cent.

The net result to the construction industry was a saving in materials due to the 20 to 25 per cent beyond a safe margin of safety. Returns on the development "just about cover the yearly cost of the division of building research."

If larger programs were recommended by the Science Council, as was likely, they would absorb a greater number of Ph.D.'s than indicated in the data presented earlier.

Another trend in industry that would help in taking up more Ph.D.'s was their promotion to managerial or supervisory positions, particularly in planning functions--operations research, systems analysis, technological forecasting.

Particularly in applied research, you also require people at M.Sc. and B.Sc. level, and a lot of these - if they go in at a B.Sc. or M.Sc. level and work in a research laboratory in industry - what they learn on the job after so many years would be equivalent to a Ph.D.

In longer range research, or in the more basic sciences, it probably would be found that a lot more Ph.D.'s were used. But certainly there was a place for the B.Sc. and the M.Sc. and probably they would still be used in larger numbers than Ph.D.'s. In the universities, however, the Ph.D. was a sort of minimum.

The N.R.C.'s 51-page brief carried 13 different appendices covering the N.R.C. Act, committees, funds provided under university grants and scholarships, a survey of 50 years of scholarships, the industrial research assistance program, listing of laboratory projects, the Technical Information Service, international agreements, conferences and symposia, personnel statistics, N.R.C. alumni, and financial information.

No. 4 - October 24th, 1968

Witnesses: Defence Research Board (R.J. Uffen, Chairman); and Department of National Defence (Major-General D.A.G. Waldock - Deputy Chief of Technical Services for engineering)

The only research in Canada on the effects of design, fabrication, materials and high stresses on underwater transducer performance is carried out at the Defence Research Establishment Atlantic.

The submission was presented in two parts: Part I dealing with DRB and Part II with armed forces activities.

DREA is one of the eight research establishments the DRB operates, in addition to headquarters, with 2,700 employees of which approximately 600 are professionals. The DRB budget for 1968-69 was $50.8 million.

DREA is concerned primarily with research related to problems of anti-submarine defence in the North Atlantic, including underwater acoustics, signal processing, and transducer research and hydrodynamics.

At the Defence Research Establishment Pacific (DREP), underwater research resources are devoted to studies of ambient sea noise, reverberation and propogation under ice in the Arctic.

At the Canadian Armament Research and Development Establishment (CARDE) the important technological areas of high sensitivity photo detectors and of lasers have been the objects of research for some years. The group is concentrating on improvements to gas lasers applications relevant to military uses for laser technology.

The work of a team of 10 scientists at CARDE in the re-entry physics program is characterized as an essential portion of the current research related to antiballistic missile

defence technology. While their expertise is mainly valuable for military purposes, their experience in aerothermodynamics, plasma physics, heat transfer, and physical chemistry of thermally heated gases is applicable to many problems of high energy and plasma flows, and the group is one of the very small number in Canada in this area.

There is also a team of nine professionals at CARDE studying the photochemical processes in the upper atmosphere. This work has such military implications as detection of ballistic missiles, and night vision. However, their research promises to shed light on climatological atmosphere.

At CARDE too there is a group of about 12 in rocket motor research. The propulsion group was responsible for the original development of the Black Brant series of research rockets, and is essential to the present development of a small reliable and cheap meteorological rocket. The CARDE technology on propellant manufacture was incorporated in the design of the Bristol Aerospace Limited plant.

The Defence Chemical, Biological and Radiation Establishment (DCBRE) carries on research into defence aspects of biological, chemical and nuclear warfare, and investigation of power sources--including batteries, fuel cells, thermionic and thermoelectric devices. The power sources division of DCBRE is the largest single group doing research and development work on batteries and fuel cells in Canada.

Virtually all the work being done on the nickel-cadmium battery system has been done at DCBRE. It has been responsible for initiating fuel cell research in Canadian industry; and has made many important contributions to technology in response to forces requirements, such as torpedo propulsion batteries, sonobuoy batteries, aircraft and search and rescue beacon batteries, and technical assistance on batteries for the Alouette satellites.

In nuclear, chemical and biological defence, DRB has developed a number of teams which represent the only Canadian R & D capability.

The protection division of DCBRE has given valuable assistance to AECL and industry in design and development of dust masks and respirators for hazardous environments. And other groups have expertise in techniques with implications for pollution control and public health.

"Unique in the western world"is the way the capability of teams in the shock and blast physics research program is described. These teams utilize the extensive shock tube and blast simulation facilities and the large free field test areas--the combination which makes them "unique".

This has resulted in a series of extensive co-operative trials with many U.S. and British agencies and thus provides one of the finest examples of an international defence co-operative program.

The space electronics team at DRTE--Defence Research Telecommunications Establishment --was responsible for the design and construction of the space craft electronics of the Alouette satellites. In ionospheric physics, the group has a number of scientific "firsts". For example, their analysis of inospheric data "constituted significant advances in the world's knowledge of the structure and characteristics of the ionosphere"

This team has developed a high frequency prediction service using a computer which forecasts the high frequencies which should be used for optimum performance in various geographic locations. The service is used extensively by the Canadian Forces and some civilian organizations.

One team is investigating ways in which radio waves can be modulated to make the best use of radio circuits with respect to power input and propogation conditions. Their work

.../6

is applicable to all kinds of radio communications--space and terrestrial, military and civil.

For many years a small team of DRB scientists has carried out research in oceanography and glaciology in the high Arctic. The board also has a team of scientists, in research on how hearing and speech perception, hearing sensitivity and acuity, in relation to voice communication, are affected by noise in the environment. A wide variety of devices for hearing protection have been evaluated both as protective and communications--assisting equipment for the Forces.

DRB work in the field of human perception is applicable not only in the military environment but also in air traffic control and ship and motor vehicle operations. The Defence Research Establishment Toronto (DRET) is engaged in sensory aspects of signal detection and vigilance, the development of signal detection theory and its application to military vigilance situations---perception of forms and shapes under difficult viewing conditions.

Detrimental effects on performance related to both mental and motor skills have been measured with both civil and military tasks in mind. Human capacilities to discriminate between closely related physiological and auditory stimuli are being investigated and the team has pioneered the development of on-line, real-time computer techniques in such investigations.

The strongest team of its kind in the country is the 60-man operational research group.

DRET also has a team of medical, scientific and technological personnel, for research on the physiological aspects of high pressures on personnel--such as a diver's escape from a submarine. The team's work on oxygen poisoning has received international recognition.

DRTE has also acquired or developed facilities for high frequency direction finding; a computer-aided facility for electronic circuitry; a microelectronic facility for studying problems in developing integrated circuits and failure mechanisms; a facility for preparing exotic materials for use in solid state circuitry and lasers, and a unique system of large-area antenna and transmitter complexes at Ottawa, Churchill and Resolute Bay for studying low frequency transmission.

Paragraphs 87 to 96 of Annex VIII deal with the economic impact of DRB's activities. Thus some known economic benefits include production orders valued at $13 million in the field of telecommunications; $100 million for the airborne doppler, $26.45 million for electronic components; $10.85 million for anti-tank armament and weapons; $1.07 million for protective clothing and equipment; $3.17 million for respirators, and $4.5 million for radiacmeters; $3.25 million for batteries, and $33 million for sonor for anti-submarine warfare.

Part II dealing with Armed Forces activities in the conclusion notes that total cost of all development, test and evaluation activities "is of the order of 1.5 to 2 per cent of the defence budget." And it is pointed out that "by any standards for an industrial country this is low."

When the nature of the expenditure on development is examined, "it is apparent that a major proportion of the activity can not be classed as innovation development but consists of procurement for test and evaluation of equipment, operation of evaluation facilities, interface engineering, adaptation of equipment.."

In general DRB has a primary responsibility for basic research and applied research and the Armed Forces for engineering development and operational systems development. The standard Department of National Defence policy is that operational systems development should be undertaken by industry.

With the increasing complexity and cost of equipment, the difficulty of selecting projects which can be justified on the basis of Canadian needs alone has increased.

.../7

Frequently Canadian procurement levels cannot justify the level of development expenditures required. It has therefore become apparent that potential foreign sales are a pre-requisite for many Canadian development projects.

It has also become increasingly apparent that defence development activities sponsored by the Department of Industry and aimed at foreign sales and industrial expansion require the support of DND in some way, to be successful. These two considerations lead to the conclusion that there is a need to view each major defence development project in a broad national sense rather than in the context of individual interested departments.

Part II gives a detailed outline of the organizational structure within the National Defence Department. Thus the Chief of Defence Staff (CDS) is responsible for formulating plans and policies to meet Canadian defence commitments, for implementing these plans, and for commanding the Armed Forces. The Chairman of the Defence Research Board is responsible for providing scientific support and advising the Minister.

Under the CDS comes the Vice-Chief of Staff, responsible for operational planning, force development, formulation of equipment requirements and determination of program priorities. The Chief of Technical Services is responsible for equipment acquisition (including development), maintenance, supply, transportation and construction engineering.

The Technical Services branch has three sub-branches--Deputy Chief Engineering (new equipment and development); Deputy Chief Logistics, and Deputy Chief Construction Engineering. In turn the engineering sub-branch is divided into five functional divisions each headed by a Director-general. These are maritime systems, ordnance systems, aerospace, communications and electronics systems, and quality assurance. There is a sixth division for systems management.

Among the main conclusions drawn in this Part II report were:

Co-operation with our allies in joint development projects is desirable;

Involvement in the international defence community provides an important means of access to extensive areas of new technology of great value in the non-defence field;

In any consideration of inter-departmental reorganization, serious consideration be given to the need to create a suitable climate and improved machinery for initiating and conducting development projects which can serve the overall national interests;

In any consideration of reorganization, it was asked that the vital importance of retaining military involvement and influence on military equipment projects should be recognized;

The extensive machinery within the defence community for the international exchange of technological information should be recognized as being of vital importance to the overall national technological capability.

Part I of the submission noted that if present financial trends continued, the number of projects would have to be reduced. Two alternatives were open: either increase the funds available or close some establishments.

Consideration should be given to the possibility of "forced attrition" by introducing incentives for early retirement and by transfers to other agencies. Under present restrictions the average age of 44 was likely to increase which was an unhealthy trend in a research organization. And the number of management jobs was limited.

Sudden major changes in government policy and funds should take into account the lead time required to make corresponding changes in research programs.

.../8

The separation of the responsibility for research and preliminary development (DRB) from that for development (CTS Branch of the Armed Forces and DOI) and procurement (DDP) presents some problems. Such a division between four agencies in three government departments was unusual in the Western Alliance.

Between 1962 and 1967 the Defence Industrial Research program sponsored 166 projects with DRB funding of $28,300,000 and an equal amount by industry. Several new industrial operations resulted.

From 1962 to 1967 patent applications were filed on 222 discoveries, and 159 patents were issued.

No. 5 - October 30 - 31st, 1968
Witness: Atomic Energy of Canada Limited (J.L. Gray, President - et al).

There are circumstances where even applied R & D is better done in government-operated facilities than in industry. One was that statistics on the relative shares of R & D in government and industry tended to understate what was done in industry. Thus, the expenditure of $10 million under the contract between AECL and Canadian General Electric for the nuclear research reactor for Whiteshell was certainly in industry and should not have been charged, as it was, as an AECL in-house expenditure.

In reporting government expenditures on R & D, the expression "done for" should be used instead of the term "done by" or "in-house". I doubt that as much R & D is actually done 'in' government laboratories as is often alleged.

It was worth considering the extent of R & D that can best be done at universities. If in 10 years' time, as had been forecast, universities were receiving more than $1 billion per annum for R & D activities, this would mean with all the supporting staff and facilities required that "there will be very little difference between" a university research centre and a government research centre, except in name.

Such an expenditure would work out to $25 million for each of 40 universities across the country each year. This would be not far short of the Chalk River establishment.

If for any reason government laboratories were less politically desirable than university institutes, the U.S. provided an example in the U.S. nuclear energy research and development laboratory at Argonne. It was run by a group of universities co-ordinated by the University of Chicago under contract with the United States Atomic Energy Commission.

Government should support R & D in industry under subsidy programs. But the majority of R & D funds should be directed toward targets the government wishes to meet. Support of work in industry not related to a government program was difficult to justify. Unless industries took some iniative to implement programs and support them technically, all the government support in the world for 'industrial research' will be an exercise in futility.

AECL was hopeful that as the market for products in the atomic energy field grew, and with encouragement for R & D in industry, we will see a change from the situation today where"such work is virtually non-existent" to management investing in R & D and whole-heartedly supporting a growing program within their companies.

There were a number of deterrents to full support by government "in our industry" -- the lack of real interest by the majority of Canadian companies in investing in R & D unless "it is fully funded and to a large extent managed by the government". In addition there were the problems of monopoly positions and of foreign ownership.

Where AECL acts as the nuclear designer and directs the development of nuclear power systems, however, all qualified suppliers have equal opportunities to bid on components. And several hundred firms are involved in equipment supplies and services for each nuclear power station.

.../9

Among "guidelines" for encouraging R & D, it was important to have an R & D centre of at least "critical" size manned by staff with training in different disciplines.

Unless plans are formulated very soon to redirect the education program or to set up expanding organizations to employ those we educate, we will find ourselves in trouble.

In the Chalk River program, AECL was trying to do two things; lower the capital cost of nuclear power plants, and increase efficiency. The effiency overall of the natural uranium reactor was about 29 or 30 per cent, and "we would like to go to 40 per cent". If that could be done AECL could afford to spend some millions of dollars and get "a good payoff". We would also like to go to higher temperatures, perhaps to a superheat in the reactor. We are in no position to offer this commercially and we will not be for five or 10 years.

Food irradiation has not really become a big thing yet in terms of supply, although its potential in the future is very big.

The types of major irradiation facilities that were coming in fairly rapidly were those used to sterilize hospital disposables such as surgical sutures and hypodermic syringes. AECL had been able to break into this market in Europe against very heavy competition.

As for Cobalt 60 machines, AECL had almost an embarrassing share of the United States market, and a very good market in Europe--France and Italy, and a developing market in Japan.

In answer to a question was AECL "wrong in putting all your nuclear atomic eggs in the heavy water basket", Mr. Gray said "we are on the right line". In addition Ontario Hydro backed up this view.

Australia had decided their national program would be heavy water natural uranium fuel reactors. South Africa also decided on this system. The reactor that the UK was offering on the open market was a heavy water reactor.

The report carries 15 appendices--covering the historical background of AECL, its structure and organization, to research policies, output, and projects, and effects of new technologies. For the period 1962-67 a number of teams were active in the fields of biology and health physics, physics, chemistry, materials science, and commercial products; they are recognized world authorities in their fields.

Over the five-year period, too, AECL pioneered various techniques--including the use of lithium-drifted germanium detectors-- which are now used in the world scientific community.

The section on "case histories" refers to several instances where commercial contractors were called in for assistance in design and development of reactor technology. Electric Reduction Company of Canada, for example, are assisting under contract in R & D aimed at an inexpensive process for upgrading heavy water.

Dilworth, Secord and Meagher, a fully-Canadian owned consulting engineering firm, owes its development laboratory to development work received from AECL. One of this firm's first major contributions to AECL was the development of the hydrostatic seal; this enabled the development laboratory to get going and also was the base for the associated manufacturing firm, Champlain Power Products who markets seal package around the world.

No. 6 - October 31st, 1968
Witness: Eldorado Nuclear Limited (W.M. Gilchrist,President - et al)

Recommended was a greater use of industrial R & D facilities by federal government departments.

These industrial laboratories are usually staffed and supervised by individuals having production experience and are therefore more 'cost conscious' in their development work on new processes and products than is sometimes the case in government 'in-house' laboratories. In

.../10

many instances, industrial research laboratories have access to pilot plant and commercial scale equipment.

It was also recommended that direct financial assistance be given industrial research laboratories. This would be a major factor in the development of the full potential of these units and their subsequent contribution to the total Canadian research effort. Such incentives should be based upon total company expenditures rather than on the annual increase in expenditures as is the case at present.

There was an interest in developing an enrichment plant in Canada. Such a process was designed to increase the percentage of U235 isotope in the mass--uranium as it occurs in nature containing only about seven-tenths of one per cent of the fissionable isotope U235 with the remaining 99.3 per cent being the non-fissionable isotope U238.

Canada should not undertake to develop an enrichment plant on its own because of the cost. A diffusion plant would take upwards of $1 billion to build even as a modest program, and that would not handle possible Canadian uranium production. Vast quantities of power are required for the process.

No. 7 - October 31st, 1968
Witness: Canadian Patents and Development Limited (B.G. Ballard, President-et al).

It would seem to be much to the advantage of the public if a governmental policy were proclaimed which would enable and generally encourage governmental research laboratories to enter into contracts with CPDL to do preliminary developments on such patentable products of research as in CPDL's opinion merit such development.

For every dollar expended in the research phase of a project 10 more dollars are required to carry it through the development phase, and perhaps an additional 100 dollars will be needed to set up for commercial production and to market it.

Public money spent on the research phase, and the benefits to the public that would accrue from placing them into use was largely just a public loss unless these additional funds, facilities and manpower necessary for development are found.

Government laboratories were limited by laboratory space, manpower, funds and their own priorities. CDL's particular trouble was with inventions that originated in one laboratory-particularly universities--where they did not have the resources to carry an invention into the preliminary development phase. This meant CPDL had to look for a full-time laboratory which would do this work.

CPDL has had only small success in acquiring licensees among the larger sized companies. So the medium and small companies--such as Guildline Instruments of Smiths Falls, Ontario--had benefited most from the patentable products.

Asked why two-thirds of the inventions in CPDL's inventory remain unlicensed, the reply was that a certain number of these inventions were not just saleable--because they were obsolete or there was no Canadian industry of the type that could use them.

Where there was no Canadian industry in the field, CPDL had to attempt to sell the idea abroad. One example was a line of high vacuum instruments; these had been licensed in the U.S., Germany and England.

CPDL was to consider proposals from licensees for cost (and risk) sharing in the engineering development phases of inventions, CPDL was normally willing to advance up to 50 per cent of the estimated cost of a project. It might require a guaranteed return from the licensee by an agreed date of some or all of CPDL's financial input regardless of sales or uses of the licensed device, process or product.

During the five-year period, 1962-63 to 1967-68 CPDL paid out in cash a total of $489,500 toward the development of inventions. A total of 17 inventions or packages of

.../11

different inventions were so assisted. Over this period CPDL was successful in finding licensees for approximately one-third of the inventions on which it is filing applications for patent.

In 1967-68 total revenue from royalties was $311,058, indicating business generated was in the order of $7,750,000. Since its inception the corporation had earned total royalties of $3,393,000. This indicated a total of about $85,000,000 in new business was generated.

The average arisings of patentable inventions forwarded to CPDL in the corporation's 20 years of handling university inventions had been about 0.14 inventions per university per year. Of the 192 university disclosures offered to CPDL only 42 applications for patent were filed and licensees had been found for only six. Five of these six had earned royalty income.

No. 8 - November 6 - 7, 1968
Witness: Science Council of Canada (O.M. Solandt,Chairman - et al)

The opening statement dealt largely with the Science Council's report "Towards a National Science Policy for Canada". This affirmed the need for national goals, identified some of the important areas, and made a number of recommendations designed to facilitate the bringing of research projects to a final conclusion.

Asked about any danger of conflict in operation with the Science Secretariat, Solandt said this will not be a problem if we are able to maintain close co-operation and intercommunication between the two bodies. There was a real need for a body such as the Science Secretariat to interpret in detail, broad policies.

In the field of science policy we are the major agency advising the government. However, the heads of other government research agencies sat on the Science Council.

One of our most important functions is not looking at specific projects within areas of expenditure, but looking at broad areas of expenditure in order to see that the trends are in the right direction and whether the money seems to be reasonably divided between the different segments of the scientific community, and suggesting alternatives in emphasis that are needed to meet changing conditions.

One of our really important problems in science in Canada today is to get an effective body for formulating national science policy in the social sciences, as well as in the natural sciences and engineering.

A minister with portfolio might help bridge the gap between recommendations of the Council and the Cabinet decision-making level.

Elaborating on this, people advising the Prime Minister directly as their job--there would only be the Science Council, but that the Prime Minister should get advice on science policy--from a wide variety of different advisors.

On educational opportunities for Ph.D's, Solandt did not agree with extremely pessimistic forecasts of new employment for these graduates. He did agree that engineering education in Canada should aim at training engineer-managers, and train engineers for the less exotic fields so important to industry.

You could not compare the government's current research effort and current gross national product. We do not relate economic growth statistically to research and development expenditure.

In the field of health care delivery systems there was need for widespread application of science, particularly systems science, to try to see if we cannot find a better way, of as good quality as we get now, but at much less cost.

It is increasingly obvious that our present health services mechanism is poorly conceived It has just grown up out of the old, primitive doctor-patient relationship, and we have added

.../12

services like nurses and so on. Health services and education were two areas where in the past there had been no commercial competition to sharpen up efficiency in prices.

No. 9 - November 20th, 1968
Witness: Atomic Energy Control Board (G.C. Lawrence, President - et al)

AECB's chief purpose is to control nuclear and radioactive materials and equipment in the interest of national security and of safety from radiation hazards.

AECB receives considerable assistance in scientific advice from a number of government research organizations, and it is one of the agencies through which the federal government supports research by grants to universities.

No. 10 - November 21st, 1968
Witness: Department of Agriculture (S.B. Williams, Deputy Minister - et al)

Its research activities are mission-or problem-oriented but broadly founded on basic, applied, and developmental research. Their aim is to improve the efficiency of production and quality of agricultural products and to develop and modify products to meet current and future market requirements.

Some of the key points were:

1. A large part of the increased productivity of Canadian agriculture, estimated at 5.5 per cent a year, can be attributed to the substantial public investment in research.

2. Whereas in the U.S., industry supported about 54 per cent of agricultural research and the federal authorities about 20 per cent, in Canada the industry share was about 10 per cent of the agricultural research effort and the federal proportion about 65 per cent.

3. The Canadian Agricultural Services Co-ordinating Committee serves as the co-ordinating body for agricultural research in Canada and reports to the federal minister of agriculture.

The need is for a central mechanism for co-ordination of agricultural R & D, education and extension, and the CASCC is capable of meeting this requirement. This organization comprises representatives from all provincial departments of agriculture, all university agricultural and veterinary medicine faculties, as well as CDA representatives, and those from provincial research organizations, and other federal departments.

An immediate increase was called for in university funding for the training of agricultural scientists. More funds should also be ear-marked for provincial extension efforts, and incentives and assistance should be provided to increase the industrial intramural research effort.

Selected university centres of specialization should be set up to avoid the over-diversification manifest in Canadian universities today. University must be encouraged to make greater use of our scientists and facilities in research education beyond the graduate level.

CANFARM--farm accounting and management system launched towards the close of 1968--represents probably the greatest forward step that we could possibly make in bringing together federal-provincial interests in the area of getting research back to the farmer.

As the system developed in sophistication it would provide such management information as whether or not the ration being fed pigs included too much barley or too little barley, or too much protein, or whether the farmer should buy his own pigs or raise them.

A number of OECD countries were studying such cost-benefit analysis techniques but

.../13

they are finding this is a very difficult field, particularly in government laboratories.

This was because the government must consider factors other than straight economics, such as social factors and also factors that are protecting a particular market -- the exclusion of a disease from Canada, for example, to protect export markets and primary producers.

CDA had a formal system of review, analysis and consideration of all projects, both on a continuing basis and on a basis of initiation.

For setting up priorities,CDA was trying to approach this problem first through cost-benefit techniques; and secondly through a group within the Economics Branch. This group would work directly with the researchers to ensure that the economic philosophy is brought to the research people.

Mr. Williams agreed in general with Senator Lamontagne"s summation that "you would like the Science Council to more or less define the size of the total pie, and then also more or less divide that pie into different sectors of research , and once a budget for research in agriculture has been determined by the Science Council you as a department with CASSC would like to be left alone to be able to determine the utilization of that sum in terms of your research programs and projects."

However, Mr. Williams added "I think we would also like to have some say in making recommendations on the cutting up of the pie.. We wish to have them continue with our CASSC in the role of observers."

In so far as industrial processes are concerned, CDA does not specialize in that area; we orient towards the producer himself.

CDA has a food processing institute, and has at three separate locations across Canada laboratories that are particularly interested in this entire question of food processing. In 1965-68 out of total expenditures of $28 million for R & D, expenditures of the department for development work were only $2.7 million.

No. 11 - November 26th, 1968
Witness: Science Council of Canada (O.M. Solandt, Chairman - et al).

Elaborated on the Science Council's proposal for a continuing technical audit of research programs at the departmental level. He could see no objection to co-ordinating the reviews of these auditing panels at either the level of a minister for science or the Treasury Board.

There was need for better planning and co-ordination of the support of research in universities, but this would have to be done at three levels--federal, provincial, and at the university level.

At the federal government level, some kind of a system would have to be evolved to present departmental new research projects "much more lucidly and effectively to the Cabinet". The staff of such a central organization would be that of a minister of science or Science Policy. And if such a minister of Science Policy were created, the Science Council should transfer its allegiance and it would be advisory to him.

We would like to see expenditure in R & D in industry grow most rapidly, the universities next, and then the government. We are in difficulties at the production and use end, these difficulties are due to the fact that we have never been able to effectively transfer the technology from government to industry.

The consensus is that the government departmental structure is not a good one for scientific research.

.../14

No. 12 - November 27th, 1968

Witness: Organization for Economic Co-operation and Development -Paris, France (S. Okita and Pierre Piganiol, examiners, and Alexander King, Director for Scientific Affairs).

Okita noted that in contrast to the general character of our science and research activities, here in Canada we feel that your emphasis is more on basic fundamental research, and that a very large part of such basic research is undertaken by government laboratories.

Japan was more oriented towards the application side of science and technology. For the fiscal year ended March 31, 1967, Japan paid out $240 million (U.S.) for imports of technology, and received $27 million (U.S.) for exports of technology. About 10 years ago this ratio was 100 to one.

In the 1966-67 fiscal year research expenditures were 1.3 per cent of GNP or about 1.6 per cent of national income. Dr. Okita said the target was about 2.5 per cent of national income.

Japan had a Science and Technology Agency established about 10 years ago. But the Ministry of Education insisted that research in universities should be outside of the Science and Technology Agency. Japan also had an elected Science Council. There were also advisory councils attached to the Minister of Education and to the Science and Technology Agency.

Piganiol described the problems of scientific research in France, with the universities, in the government sphere involving co-ordination and channelling effort towards national goals. France had not dealt with genetics for 40 years; within physics and chemistry there were certain areas untouched.

Since about 1936 France has had the National Scientific Research Centre (CNRS) which aims to help universities through grants and to direct its own laboratories involved in important scientific problems. However, the CNRS had run into administrative problems.

One of the tasks of a government agency was to take an inventory of R & D, to show the results of particular projects. This was assigned to the delegation to scientific and technical research. This delegation spoke through the federal minister in charge of scientific and technical research and atomic and space affairs to the prime minister; and it served as a secretariat to an inter-ministerial committee which grouped together all ministries involved in science.

France has a council made up of 12 scientists chosen from a wide variety of fields. Members are entitled to vote at meetings of the interministerial committee.

A control agency was also required, which may intervene quite directly in emergency situations. The co-ordination process consists of choosing topics of national interest and setting up a plan for studying them, a plan which binds various university, government or industrial laboratories by contract to collaborate.

DIGEST OF THE PROCEEDINGS OF THE SENATE COMMITTEE
ON SCIENCE POLICY

Second of Four Parts - (Reports No. 13 - 29)

No. 13 - November 27th and 28th, 1968

National Health and Welfare

Recommendations on national science policy were: Early application of systems analysis to educational systems in Canada in the light of present and future requirements for trained personnel; establish a nationwide information network and a government clearinghouse capability; start an ongoing Canada health survey with the 1971 census; include representation on the Science Council from social and behavioural sciences; establish a central agency as a clearinghouse for international scientific activities; and provide adequate support for fundamental research.

While the department's intramural research program in the food and drug laboratories, the virus laboratory, the laboratory of hygiene, the radiation protection laboratory, and the environmental health health laboratory are closely tied to statutory obligations, scientific activities permeate the day-to-day work of various units.

Research activities carried out are mission-or problem oriented and chiefly of an applied nature. Perhaps 8 to 10 per cent involved basic research.

In addition extramural research may be assisted under the Public Health Research Grant, The Hospital Insurance and Diagnostic Service Act, The Fitness and Amateur Sport Act, and under welfare grants. Extramural research is also conducted by clinical investigators under contract for the Food and Drug Directorate.

Clinical research is also permitted under the Hospital Insurance and Diagnostic Services Act. Most of these research projects are conducted by researchers who receive financial support from the Public Health Research Grant.

The Laboratory of hygiene in its biologics control laboratories, has the twofold function of controlling biological drugs, and public health matters involving research on bacterial vaccines, serum products and public health laboratory testing.

In this work, a new nethod of producing vaccines was developed. This product is the subject of two separate patents filed by Canadian Patents and Development Corporation; and patents are issued or are pending in 42 countries. The laboratory's first experimental preparation--a staphylooccus vaccine-- is now being produced by a commercial firm in the U.S.

The medical services branch, whose responsibilities take in the health of various categories of persons such as the travelling public and indigenous ethic groups, outside the jurisdiction of normal provincial health services, carries out such scientific activities as Eskimo nutrition, protection of patients from the elements, clinical trials of new drugs, and various sanitary investigations.

This branch arranges for field trials of new vaccines and drugs, and stimulates research projects, usually at universities, to solve specific problems. The branch also has a number of agreements with Faculties of Medicine which provide for senior medical undergrads working in branch hospitals and health centres. Similar arrangements are made for public health nursing.

On the welfare side, the department had a research grant under the National Welfare Grant Program. There was also a grant program under the Fitness and Amateur Sport Act, and three research units have been set up across Canada in this field.

In social development the research and statistics section had carried out a wide range of activities--such as program development under the Canada Pension Plan or the Canada Assistance Plan.

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The Medical Research Council was a special department of the government for the purposes of the Financial Administration Act, but reports through the Minister of National Health and Welfare. The National Research Council was no longer offering grants in the field of medical research.

The departmental committee on communication led to a complete system analysis of information problems from coast to coast. The main objective was to provide scientific and technical information in both health and welfare fields. Qualified users would be the scientist, the professional man, and the lay public.

The plan calls for a nation-wide network with "nets" at the regional levels to serve the regions. These regional nets would be administered by the provinces. At least one province had already developed a complete net covering the wide range of all psychiatric services. The next stage would be general hospital services. The ultimate objective is to have a complete nation-wide net. The centre in the Department would undertake the broad co-ordination and perform liaison functions with foreign countries.

The department had carried a continuing inventory with regard to doctors and dentists. Surveys of social workers had also been carried out from time to time.

In training of professional people in Canada, the universities had trained personnel according to what the board of governors decided. There had been a tendency not to relate this necessarily to the social needs of the country.

Page 1402 describes the unique criteria developed by the Public Service Commission research and test development division to help identify people who will be creative and effective researchers.

In its statement on a national science policy, the brief deals with the need for a national policy-making body; the need at the departmental level of more systematic scientific and technical information on what other departments are going; resolving problems of co-ordination between departments, and expansion of the existing interdepartmental structure; and endorses the Science Council's proposal for large, multidisciplinary, mission-oriented projects in relation to national problems.

No. 14 - November 28th, 1968
Department of Veterans Affairs.

Original objectives of the DVA clinical research program as first set out in 1950 were:

(a) To create conditions..whereby clinicians, medical scientists and para-medical scientists are given the opportunity to explore new ideas on a full-time or part-time basis;

(b) To promote the investigation of diseases and disabilities that are associated with hazards of military service...

(c) To promote, in collaboration with university medical schools, the pursuit of investigations that are valuable adjuncts to educational, training programs.

Since the end of World War II, interest in disabilities directly attributable to military hazards has declined, and the work has focused more and more on "chronic, slowly developing disabilities such as arthritis, rheumatism, diseases of lungs, livers and kidneys, and cardiovascular and nervous systems. At the present time, of 67 planned research projects 30 represented investigations of such chronic diseases.

Government policy is to phase out the hospitals in line with the recommendations of the Glassco Commission. The commission said all DVA hospitals should be transferred to the province or other corporate boards.

No. 15 - December 11th, 1968
Department of Fisheries and Forestry

Canada can claim the most outstanding success, in so far as protection of the forests is concerned by the use of parasites and pathogenic microorganisms.

The Department of Fisheries and Forestry collaborated with the Department of Agriculture and an international institute known as the Commonwealth Institute of Biological Control.

The Forestry Branch carries out research in seven regional establishments, two forest products laboratories (one in Ottawa and one in Vancouver), and seven institutes.

The institutes comprise the Insect Pathology Research Institute at Sault Ste. Marie; the Chemical Control Research Institute at Ottawa (use of insecticides and other chemicals); The Forest Fire Research Institute, Ottawa; the Forest Management Institute, Ottawa; the Forest Ecology Institute, Ottawa (forest soils, physics, chemistry and microbiology); the Petawawa Forest Experiment Station, Chalk River (silviculture, ecology, tree breeding, and fire research); and the Forest Economics Research Institute, Ottawa.

Basic objective of the Forestry Branch's research program is to provide the scientific, technological and economic information and services required by federal and provincial government agencies and private industry, to assure the maximum contribution from the forestry sector to the industrial development and the economic growth of the country.

In recent years there has been a notable change in the nature of the research program of the Forestry Branch and a better balance is being achieved. Formerly, the branch operated largely at the interface between basic and applies areas. Now more attention is being given to the applied and developmental areas.

The present level of research on forestry and forest products amount to $43 million, and this is not considered adequate. Of this amount industry provides 51 per cent, largely in the products field; the federal government provides 42 per cent, the provinces four per cent, and the universities about 3 per cent.

In addition to its "in-house" research program, the branch provides extramural research grants to university staff members for projects that complement or supplement the branch program. There is also a small program of contracting out developmental projects and operational trials.

Program development in the Forestry Branch is guided by regional advisory committees in the forest research field, and by groups of industry specialists in the forest products field. Program co-ordination across all branch establishments is effected by senior specialists at branch headquarters.

No. 16 - December 11th, 1968
Department of Energy, Mines and Resources

Dr. C.M. Isbister, Dep. Minister

Most activities are directly concerned with development of resources of the country. The control surveys and mapping are fundamental for the development of the country as a whole. Our Inland Waters Branch is designed to meet the need for knowledge about water pollution and its abatement. Mines Branch deals with problems of mining and mineral processing. Marine Sciences Branch carries out studies that will enable the mineral and petroleum industries to explore the continental shelves and ocean bottoms. The Geological Survey is the exploration arm for government. Observatories Branch provides data on problems of defence, mineral exploration, and earthquake prediction. The economic units study trends and development of resources.

We see fairly substantial increases in the future in the scientific activities of the

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Department. We do not anticipate serious difficulties in recruiting the right people.

At Canada Centre for Inland Waters formal involvement at the planning stage is being invited from numerous agencies. An advisory committee is being formed, including representatives from other government departments, universities, industry.

To eliminate old programs of diminishing utility, it is suggested that there be more freedom of movement between government and outside agencies; and encourage retirement betwen ages 50 and 60 without serious loss of pension for those who are at a dead end because of program termination or their own inability to fit in with changed plans of the agency.

Considerably more scientific date-collecting could be contracted to industry.

We think it most undesirable for the research to be under the control of a single ministry for science.

Dr. A.T. Prince, Dir. Inland Water Branch

With present technology and sufficient funding conditions would improve very substantially in the Great Lakes area within the next five years. But pollution abatement based on present technologies is only a percentage removal of the pollutants - there is always the escape of 10 or 20 per cent of whatever is involved and it is the accumulation of these escaped amount that is the serious thing because it is cumulative. So we are endeavoring to understand the environment. I do not concur in the idea that the solution to the pollution problem long term could be solved simply by abatement measures as they now exist.

NO. 17 - December 12th, 1968.
Department of Fisheries and Forestry.

All the basic objectives and purposes of the Department of Fisheries require a scientific basis. Objectives of the department are protection of the resource, increasing yields, also increasing the efficiency of the industry, developing, demonstrating and introducing new fishing methods, and controlling quality in processing.

Under the international agreements, a great deal of research is also required by all the countries concerned.

The Fisheries Research Board is the research arm of the federal Department of Fisheries. FRB is the oldest government-supported scientific board in North America--having originated in 1898. The board consists of a full-time chairman and up to 18 honorary members appointed by the minister for five-year terms. At present, 10 are university scientists, seven are representatives of the fishing industry, and one is an appointee from the Department of Fisheries.

The board operates regional laboratories from coast to coast. These include(1967-68) the St. John's, Nfld. biological station; the Dartmouth, NS marine ecology laboratory; the Halifax laboratory; the St. Andrews,NB biological station; the Ellerslie, PEI oyster unit; the St. John's Nfld. technological unit; the Grand Riviere, Que. technological station; the Ste. Anne de Bellevue biological station; the Winnipeg freshwater institute, the Nanaimo, BC biological station, and the Vancouver laboratory.

Annual expenditures must be at least doubled over the next 10 years to meet its expanded responsibilities--even if the effort were limited to uniquely Canadian fields.

FRB's special talents should be given scope for development in respect to the urgent inter-departmental assault on freshwater and marine pollution.

Studies should be made to develop utilization of poorly understood resources, to reduce the cost of fishing, to step up research on fish behaviour as a basis for development

of new apparatus and fishing techniques; to improve the quality of products.

Work should increase to find effective positive measures to increase the supply of valuable species, such as lobsters, oysters and salmon.

There should be closer collaboration with universities both to ensure the supply of talented recruits to fisheries research, and to increase fundamental research.

On pollution, FRB's area of concern is in the division of responsibilities among several federal departments. The only federal legislation, outside of navigable waters, which could be used to prevent pollution was concerned with the fitness of the water for fish. If the pollution question came up in the courts, there would be questions on how much of various substances can be tolerated and on what level they can be considered pollutants; FRB has a responsibility to define the level of pollution for various classes of substances which are deleterious to fish.

No. 18 - December 18th, 1968
Department of Transport

Five main areas within the Department fall within the scope of the committee. These are the Marine Hydraulics Branch, the St. Lawrence Ship Channel Division, Marine Hydraulics Branch, the Meteorological Branch, the Transportation Policy and Research Branch and the Telecommunications and Electronics Branch.

The Marine Hydraulics Branch operates in the areas of applied research and development and in data collecting. Research activities relate to water resource management, navigation channel design, behaviour of ships in confined waterways, sediment transport and ice phenomena.

The Transportation Policy and Research Branch, carried out economic appraisals and studies of various types, rendered assistance in the implementation of programs, and co-ordinated departmental activities for inter-departmental committees, in addition to other services.

The Meteorological Branch operates a service which predates Confederation. Its main objective is to provide meteorological service for the benefit of the people of Canada. It is charged with providing information concerning the atmosphere, and also to promote meteorological science in Canada. It also has to undertake certain allied scientific tasks--such as the network for observing ice in navigable waters.

Most of the research is done in the climatology and research and training divisons. For example, the climatology division has hundreds of millions of punched cards containing weather data. All the rest of the research, basic and applied, particularly in support of forecasting and training activities, is carried out by the other division.

Some of the areas of investigation include precipitation amounts, intensities and distribution; clouds, fog and visibility; wind strengths and direction; severe storms, temperature and humidity, and aircraft flight conditions.

A few continuing projects include research to develop a system for automated short-range aviation forecasting; R and D on reception and use of radar and weather satellite observations for weather forecasting; development of automatic weather stations to measure and transmit unattended the standard weather elements.

The Telecommunications Policy and Administrative Bureau--as it is now known-- is still involved in research on satellites under the International Civil Aviation Organization. These include studies about providing satellites for position fixing for aircraft and/or marine uses, and the possibility of using them for more accurate air traffic control.

No. 19 - December 18th, 1968
Canadian National Railways.

The three recommendations were formation of a national transportation research council; a soils dynamics organization to co-ordinate work in Canada on soils mechanics and dynamics; and a transportation data bank.

CNR operates a technical research laboratory in St. Laurent, Que. The three branches employ about 150 people. Of these approximately 98 are in technical research, 19 in operational research and about 30 in development planning.

Envisaged this proposed transportation research council making grants to universities in certain specialized areas. There also could be research institutes set up across Canada.

On the proposed soils dynamics organization, with Canada's climate conditions and particularly because the railways are likely to play an expanding role in Northern Canada where the problems of soil mechanics will be certainly quite severe and perhaps unique in this country, there is need of co-ordination of the work.

No. 20 - December 19th, 1968
Canadian Transport Commission

CTC has the responsibility of developing a strong research establishment to underpin the development of broad and consistent national transportation policies. It has adopted a program of research ranging from a possible data bank, techniques for forecasting transportation demand, to evaluation of the impact of new technology--such as containerization, hovercraft, solids pipelines, unit trains, supersonic jets, icebreaking techniques, nuclear submarines, monorail systems, air cushion train operations, and such urban forms of transport as the teletrans system.

Canada should be aiming at a research program by 1973 in the order of $15 million--instead of the earlier modest estimate of $3 million. The CTC would look to the National Research Council to carry out any physical trials required, and it was the aim to work with universities or other institutes in the same way.

Three universities in Canada stood out from all the others in the amount of work they do in the field of transportation. These were UBC, Manitoba, and Waterloo (Transportation engineering). The commission should aim at no more than five "centres of excellence" across Canada.

No. 21. - January 29th, 1969
National Research Council

In its second appearance NRC provided supplementary information on 35 case histories, and an annotated list of more than 900 intramural projects.

Each case history tells how the program started, includes a brief description of the work done, the economic aspects of the project, and what important points it illustrates.

Senator Grosart was delegated by the committee to run through the case histories and ask NRC representatives for further comments. He first raised the question of technical audit.

Dr. L G. Cook, delegue general, NRC, said he agreed on the question of technical audits. NRC was trying to make the point that there was very great difficulty in technical programs of dealing strictly on an annual basis with accomplishments.

The case histories illustrate both fundamental research and development. They embrace, to mention a few, radio astronomy, structure and properties of free radicals, spherical agglomeration of materials, physical standards, development of rapeseed as a crop in Canada, innovations in military and geophysical airborne magnetometry, a vascular suturing instrument, the crash position indicator, wave absorption breakwater, microwave drying, ear defenders, improvement of sealed double glazing for windows, and special groups illustrating involved decision making.

.../7

No. 22 -- January 30th, 1969
Science Secretariat

Separation of the Science Secretariat and the Science Council would give the Science Council greater freedom and flexibility to perform the functions and accept the responsibilities given to it.

This would mean the Science Council could become the main public forum for advice to the government on the broad problems of science, such as how our financial and human resources should be allocated to enhance the country's scientific capability and result in the best economic and social returns.

It(the Science Council) would also have the freedom to comment--on the role to the university and industrial sectors of the community in scientific and technological matters.

From 1966 until November, 1968 the Science Secretariat had performed a dual role. But the responsibilities for providing professional, clerical and administrative services for the Science Council had been terminated.

The Science secretariat was best located in the Privy Council Office. There, as one of its prime responsibilities, it could try to ensure that wherever appropriate, science and technology are harnessed to the pursuit of the government's objectives. And since the Science Secretariat would participate in determining priorities, it had to keep abreast of scientific activities in Canada and abroad.

The Secretariat is "the scientific arm of the Privy Council Office". It receives requests for background information and for assistance in dealing with parliamentary questions on science from the Prime Minister, Cabinet Committees, the Cabinet Secretariat and Treasury Board. It also advises the government in the field of international science policy.

There is a need for a planning body to co-ordinate scientific research within the government structure. Since the Science Secretariat had no operating or granting responsibilitie it was particularly well placed to undertake this function since it could take a neutral and dispassionate view of science matters affecting departments and agencies of government.

The term Science policy was a synthesis of those policies of government which relate to problems with a scientific and technological content. It was a gross oversimplification to talk of a unified science policy in the same terms as you would talk of a broadcasting policy or a housing policy.

It was reasonable to speak of a unified government policy towards fundamental science.

But government scientific activities not directly involved with socioeconomic and political goals were only a fraction of the total. In agriculture, transportation, space or pollution there were common popular factors in scientific and technological activities. The greatest of these was the employment of scientists and engineers. Overall science policy had to look at this overall problem.

Fed by the university, the scientific community is a dynamic system which continually demand to know where or how it can best serve the nation. Moreover there are scientific disciplines, methods, techniques and institutions which are common to many practical programs and which are not separated identifiably with socio-economic or political missions.

For these reasons policies for science in various parts of the government had all to be accounted for in determination of science policy. The difficulty lies not only in assigning priorities in the national interest, but in insuring that government action makes best use of the scientific resources available.

The need of inventory studies in assessing scientific work done in various sectors

... /8

and in avoiding overlapping was recognized by the Science Secretariat before the Science Council was established.

No. 23 - January 30th, 1969
Bank of Canada

The presentation dealt largely with research in econometrics and the development of an econometric model with the ultimate objective of obtaining internally consistent answers to the effects of monetary policy measures.

The model is an attempt to portray economic activity by means of a related set of equations that depict in some sense the activity of various sectors of the economy, and relate these together in a model which somehow attempts to capture the simultaneity or the related character of activities in various areas of the economy.

The practical use of such a model depends upon a continuance into the future of the relationship between the various variables that are incorporated into the hundred equations. It was very difficult to incorporate expectations into such a model.

On the Bank of Canada's recommendation that a centralized bureau of economic data on computer file be made available through the Dominion Bureau of Statistics. It was not all clear where a service of this kind should be performed.

There were many economic series which would be useful for other people to be able to tap into directly, and that arrangement was going ahead on some scale. They will shortly be able to provide a service like that between the Bank and the DBS, and it is quite possible that the Bank can start out with as many as 10,000 of the economic and financial series.

A great deal of research at the Bank is policy oriented, a by-product of this research will be studies of processes like how prices are determined, how the labor market reacts. A lot of this output would take the form of research monographs, and the majority of them would probably be published.

No. 24 - February 5th, 1969
Dominion Bureau of Statistics

The bureau is charged with co-ordinating the statistical activities in Canada. Another important function was to do a certain amount of research in fields such as productivity, price movements, balance of payments, financial institutions, demography and manpower. A third area of importance was that of survey methods research, research in matters of data processing input and retrieval, and automation.

The 158 page brief covered such aspects as organization of the bureau, the subject matter covered by DBS, research and development, statistical production, users and suppliers of data, relationship with agencies abroad, and future plans. In addition, two memoranda were presented: one dealing with research and development surveys in the physical sciences, and the other with the possibility of research and development surveys in the social sciences.

In the case of the physical sciences, there are two surveys, one in industrial research which is a biennial survey, and a survey of research in physical science in the federal government, and annual publication.

The survey of industrial research included some research foundations of provincial governments. The possibility now exists of making the report an annual one. An effort was made to publish preliminary figures in the DBS Daily Bulletin seven months before the appearance of the publication itself. A preliminary report was also published on research in the federal government.

Yet to be investigated was the field of research in universities. While the NRC and the MRC had done some work in this area, it is possible that a greater co-ordinating role

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should be played by the DBS.

The bureau did not yet have a survey program measuring the extent of research in the social sciences. Such a program had been under consideration for some years, but until recent years there had not been a great demand for this information. DBS plans to add additional staff early in the new fiscal year to begin active exploration of the survey needs of users with the idea of setting up a regular survey in this field. One of the practical problems was the failure of OECD and UNESCO to arrive at international standards.

Statistical activity was becoming an interdisplinary matter. There were experts in the bureau in computer technology, in the science of taking surveys, the mathematical statistician, who lent back-up support to the subject-area expert. DBS does not often find a subject matter expert who has some computer background, so it becomes necessary to do a good deal of training and education.

The bureau had hired university professors to do particular jobs during the summer. There was also an arrangement whereby final year students were brought into the DBS for work during the summer.

It would be difficult to decide what a course specifically designed to train people for the bureau in universities would contain. There was a need for the "generalists" in statistics, but more and more the direction had been in fostering specialist work in an interdisciplinary fashion.

The social science teaching in Canadian universities has not been as integrated with governmental activities and needs and general community needs, as, say, in the United Kingdom and the United States. This, in turn, has a great deal of feed-back into the research programs.

DBS elaborated on the time series bank started initially by a young econometrician in the Economic Council. This program had been in use in the DBS, in the Economic Council and the Bank of Canada since then.

About two years ago the Economic Council and the DBS co-operated in an attempt to construct a system whereby all publishable time series data available at the bureau could be put in readily accessible form. Construction of this program had now been completed.

When the "kinks" had been ironed out, the bureau planned to offer a "standard Package" of up to 7,000 time series--the most commonly used series in the Canadian Statistical Review.

No. 25 - February 5th, 1969
Economic Council

There was scope for improvement in the Canadian economy in the quality of management, improved capacity to manage the whole process of technological change.

There was a great deal to lean about how innovation plays a role in economic progress. The Council had attempted in its Fifth Annual Review to identify some of the areas where efforts could be made to improve innovative capacity.

In addition to improved management capacity, these included improving access to and diffusion of knowledge; emphasis on policies facilitating adjustment to change (getting rid of "rigidities") such as manpower policies; and the importance of competition as a spur to adopting new knowledge in better ways.

Dr. Smith also discussed the Council's research program and set out its policy goals of high employment, growth, cost and price stability, balance of payments viability, and sharing among Canadians in rising living standards.

The quality of much of DBS data, while it has been improved, needs to be improved

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further. It was very important for the bureau to strengthen the analytical capabilities.

Longer term projections of economic growth were becoming much more important, but tools were not very good. The Council had decided to concentrate on the medium term, in the five to seven-year range, because a great deal of the decision-making took place in that area.

On the recommendation that a special research institute be set up in Canada to deal with the short-term economic outlook, it was said -There is not a public institution in Canada that provides information that is generally available and that can serve private firms and institutions, in an open way, as a basis for discussion and debate.

At this state no country has a coherent science policy. There may be some that do not want a science policy. Some new institution created in some way was not necessarily going to achieve a "coherent strategy".

On the Council's point that there should be more emphasis on industrial research and technology, given the importance of the whole innovative process, performing a larger segment of the R and D activity closer to where the whole innovative process takes place makes a good deal of sense.

Referred to a list of factors given in the Council's report that helped explain the greater degree of successful innovation in the U.S. These included venture capital, technologically oriented universities, and good entrepreneurs. There appeared to be a wide gap between Canada and the U.S. in schooling of management, and the business school education system in Canada was much less developed.

Canada should maintain very good knowledge of, and access to, foreign information in the R and D field.

Making international comparisons of the proportions of expenditure on R and D and GNP was virtually a meaningless operation. The important thing was how you use R and D, not what you spend on it.

No. 26 - February 6th, 1969
Treasury Board

Secretary of the Treasury Board, S. Simon Reisman's brief described the organization of the Treasury Board and its functions, allocation of resources, planning programming, budgeting system, and federal support of Canadian science and technology.

Mr. Reisman described the process which starts with program forecast submissions by departments covering a five-year forecast of plans, the overall view of these forecasts that has to be taken by Treasury Board, and approval in principle of departmental plans for the ensuing year after detailed discussions and consultations.

Each department was guided by expenditure guidelines set up by the Cabinet. These involved a careful appraisal of the state of the economy and financial resources available. The advice of experts in the Department of Finance, the Treasury Board Secretariat and the Privy Council Office might be drawn upon.

"We do not have any ouija board or any magic implements of any kind" for reaching budgetary decisions, Mr. Resiman said. Budgeting at the national level became an exercise in rationing the available resources among competing claims.

The board in its current work was operating "within the framework of governmental policy which views science and technology as essential ingredients in an advancing economy". It was felt that "a reasonable amount of basic research warrants national support as a means of creating new knowledge, building a core of scientifically motivated personnel and preserving a scientific awareness throughout the country".

.../11

There was also a broad view that there was need for expanding applied research directed to solving problems of national concern in the economic, social, and cultural fields. Coupled with this was "the need for a balanced program of industrial development and technological innovation".

Thus, the Treasury Board had been enabled to identify selected areas of broad research and development activity that justified priority treatment. Hence, in an endeavour to encourage greater support of medical, scientific and engineering research performed in non-government facilities, increases in grants in aid had been approved in estimates for 1968-69 and again in 1969-70.

But because statutory and other commitments account for about 50 per cent of annual expenditures, a highly selective attitude had to be taken in other fields of proposed expenditure.

Federal government support of all Canadian R and D in universities, industry and in government facilities increased from $202 million in 1960-61 to an expected $520 million during the current fiscal year. This represented approximately 50 per cent of all R and D to be made in Canada in the current year.

Mr. Reisman noted that the original program forecast submissions for the 1969-70 fiscal year would have involved expenditures approaching $1 billion higher than what the government said it had available.

There were certain R and D projects of such a magnitude, he said, that they had to be referred to independent agencies, such as the Science Secretariat and the Science Council for assessment. Such was the case with TRIUMF--Tri-University Meson Facility--a major new development in accelerator technology by three west coast universities. This proposal would cost in the order of $25 million over seven years, and would be a co-operative undertaking between the federal government and the universities.

A considerable part of the evidence was devoted to a discussion as to whether the estimates might be presented in a new way -- a sort of "science budget"--to indicate scientific expenditures in relation to particular projects. But Mr. Reisman maintained that relating scientific expenditures to a function was "a more useful way of doing it".

No. 27 - February 6th, 1969
Department of Labor

The Department of Labor has a research and development program embracing five branches with major research activities concentrated in two of them. Basic purpose of the program "is to improve the quality of public and private decision-making on policy formulation and program administration in the labor field.."

Harry J. Waisglass, Chairman, inter-departmental committee of socio-economic research, told the committee one major area of research is industrial relations. Another program area was labor standards.

Specifically, the department's research and development program aimed at improving and applying the knowledge, methods and techniques of the social sciences towards the solution of social and economic problems, anticipating and identifying emerging problems, evaluating existing policies and programs, and providing objective and timely data to unions, management, government agencies and the public.

Because of shortages of staff, they give more of their attention to the immediate problems and the kind of problems they can anticipate in the near term and to ready themselves to face anticipated problems.

The department's grants to universities over the years has been very useful in developing a body of scholars -- such as Professor Meltz, Dean Woods, and Dr. Sylvia Ostry.

.../12

In the area of "social justice"--the non-employed, the drop-outs and the hard core unemployed--he believed that a great deal more attention was required. The department had some programs in that area, and has been giving attention to developing some programs in research.

The successful adaptation to technological change was an area "that to a large extent industry is more concerned." And a great deal of research could be done in this field. But problems of that kind might be tackled better on an inter-departmental basis.

On the question about research into the causes of strikes, the department has a long term research program underway. This project had been undertaken by Dr. Garfield Clock, trained in the UK and with some experience in conducting studies there into industrial unrest.

The brief underscored that "among the major limiting factors for the conduct of scientific activity (in the department) are the inadequate supply of highly qualified professionals, and the problems of their recruitment, retention and effective utilization".

No. 28 - February 12th, 1969
Manpower and Immigration

The fundamental objectives of scientific research activity in the Department of Manpower and Immigration are to ensure that departmental policies and programs are developed.. to make the maximum contribution to the attainment of the departmental goals, and that relevant data is collected and analyzed to support the departmental operations.

These goals, are directed towards "the effective allocation of manpower resources and the development of the labor force and its characteristics compatible with the maximum sustainable rate of economic growth of the Canadian economy".

Dr. W.R. Dymond, assistant deputy minister, program development, told the committee that it has come to be realized that "the human factor in production is relatively more important in economic growth than is capital or the application of technology".

The research branch of the department is basically concerned with "the longer term and more fundamental research activities in the field of manpower and immigration which would in a long run sense stand behind future changes in policy.." Dr. Dymond told Senator Thompson. The background research "would enable any changes in programs and policies to be thought through and developed in a wider context than just an immediate day-to-day context".

In addition, the department's "scientific activities" embrace the Manpower Information and Analysis Branch. This is focused on the generation of current information on labor supply and demand.

Asked whether research was being done on the impact of technology on the worker, Dr. Dymond said there was a section dealing with the impact of technological change on manpower requirements. He cited a study on the effect of increasing mechanization of the eastern logging industry on labor requirements.

Asked about the relation of the department's mobility program to regional development plans. Dr. Dymond agreed with Senator Lamontagne, the Chairman, that most of the regional plans involved either greater mobility of labor or training and re-training, and "the tools at the government's disposal came from M & I".

The "Brain Drain" to the U.S. was "something of a fallacy", K.V. Pankhurst, Chief, manpower requirements section, said in answer to another question. He said the figures were incomplete since they did not show "returning Canadian residents who have been to the United States".

Senator Grosart wanted to know if there were any built-in restrictions of professional associations in Canada relating to immigrants. Dr. Dymond said the research branch was looking

.../13

into this at the levels of all trades and professions to see whether there were restrictions that inhibited acceptance of qualifications of immigrants. "Fruitful discussions" had been held with the medical associations, the engineers and the agriculture profession.

The department issued briefs for the use of officers overseas and potential immigrants overseas, setting out entrance requirements for various professions and occupations. Dr. Dymond admitted that the department "would like to see an objective and liberal approach taken to the question of trade and professional qualifications", but legislation in this field was a provincial matter.

On the immigration side, Dr. Dymond said the department had begun a "longitudinal study" on January 1st, 1969 dealing with "Economic and social integration of a representative cohort of immigrants during their first years in Canada". This embraced a sample of 10,000 immigrants that come in every year, and would cost hundreds of thousands of dollars.

No. 29 - February 12th, 1969
Public Service Commission

The Public Service Commission is responsible for only about half the research scientists hired by the federal government, John J. Carson, chairman of the PSC told the committee. The other half is hired by independent research agencies.

Because of the lack of good long-range planning about the kind of direction scientific activity was going to take in the federal government, Mr. Carson said "We are not in a position to give the sources of supply adequate lead time to be able to produce the kind of product we are going to need at the moment we need it".

The PSC brief noted certain "syndromes" might be recognized in the relationship between the government and the universities. There was the "ivory-tower" syndrome which was characterized by universities, government departments and industry expanding investigations in identical areas; and the tendency of certain scientific activities, once they got started moving, to continue independently of any change in the supply and demand situation.'

The brief also drew attention to certain problems in government staffing operations. On occasion, for example, various scientific agencies of government might be in competition for the same types of individuals. A unified approach was required. This was not likely to be achieved "until the total staffing function was integrated into a national priority and policy network."

At the present time, responsibility was divided among too many agencies to permit an effective overall program of manpower management.

Universities must be made aware of "national needs and priorities", the brief said. There appeared to be a need for greater co-operation and co-ordination among the universities themselves, and greater participation by universities with government and with industry in the formulation and implementation of national policies and priorities.

Dr. Donald H. Laughland, Director, biophysical sciences program, described the methods of evaluation used in recruiting scientists in the biological and physical sciences. An interdepartmental appraisal committee accepted or modified departmental recommendations on salaries.

There were four grades in the Research Scientist Class. The range for this class--designed to ensure consistent career treatment for the individual wishing to stay in research--was from $10,500 for a Ph.D. up to a maximum of $23,000 or $24,000.

Mr. Carson said the PSC had "been anxious to get the same kind of coherent attack on the problem of the research scientist in the social sciences". But departmental use of the social scientists was not nearly well developed, "and there is no experience with the management of this kind of resource..."

.../14

He pointed out that the new act in 1967 permitted the commission to make appointments "without running....terribly laborious competitions". It was a simple matter now, if there were only two qualified people in Canada for a specific scientific post, to get them on the phone--that is the departmental research manager--and find out which one is available. It could all be done in five minutes.

Dr. Laughland said the salary structure in the Public Service now "is quite competitive with industry and the universities".

Mr. Carson said "we think we are in a position to co-operate with providing services to all departments and agencies of government and that we can do it probably more completely, more economically and just as rapidly as a bunch of individual entrepreneurs going out on their own could do". The PSC was negotiating with a number of agencies of government to start providing employment services to them.

DIGEST OF THE PROCEEDINGS OF THE SENATE COMMITTEE
ON SCIENCE POLICY

Third of Four Parts - (Reports No. 30 - 41)

No. 30 - February 13th, 1969
Medical Research Council

The Medical Research Council evolved from the Associate Committee on Medical Research set up in 1937 when General A.G.L. McNaughton was president of the National Research Council. In 1946 this became the Division of Medical Research at NRC. Then in 1960, following the Farquharson Report, the MRC was set up as an autonomous body within the administrative framework of NRC.

Then the decision was taken in 1968 that the MRC should report to Parliament through the Minister of National Health and Welfare.

The policies of the Medical Research Council centre around three goals: to contribute to new knowledge in the health care area; by support of research, to develop and support the scientific and technological back-up for provision of health care; and to develop and support the research component in the education of health care personnel.

About 70 per cent of funds available to MRC are used in supporting specific research programs directed by scientists across the country. These are part basic research, part applied, and part development research. The projects take in fundamental research in universities, in medical schools, right to the bedside and in the laboratory.

Dr. G. Malcolm Brown, Chairman of MRC, told the Committee that the council was a "Working Council". It has the authority to make its own policies, and to make decisions regarding the spending of money which has been voted to it by Parliament.

The second largest component of the council's efforts in terms of money spent was concerned with the support of research trainees. Until recently this training program had the highest priority...but it is not possible to give them the degree of support that was once given.

It was "the strong and unanimous opinion of the MRC that the corporate agency structure is the organizational structure which is appropriate to it and which will best permit it to do its job".

The Council stressed the need first of all to decide on social goals, and then to decide on the extent to which progress towards a particular goal can be made in a scientific fashion. The third step would be to determine the extent to which programs will depend on further new research in the field.

The brief also touched upon some immediate problems in the health sciences area. One of the most important contributions research could make to ensuring a high level of health care was to shorten the gap between acquisition of new knowledge and its application. In addition, MRC was concerned with special problems such as those posed by the field of biomedical engineering. This was a field that was "ripe for advance".

Dr. Brown also mentioned the problems presented by the "delivery of health care". This concerned the interface between health science research and sociology and economics. Operational research was "just as much a necessary complement of medical research...as is the development and production in factories of various products which arise from innovations and inventions of laboratories".

Dr. Brown said the Medical Research Council provides 60 per cent of the extramural funds reaching the medical schools from all sources or 80 per cent of the federal contribution. During the past 10 years there had been a considerable re-arrangement of sources. MRC's budget

.../2

had risen from $2 million in the period to $26.9 million in 1968-69, but other contributions had not increased at the same rate.

The award rate in 1969 and 1970 was "going to be a good deal less than 50 per cent". Over the past three years, Dr. Brown explained, the applications the council would like to see supported had been growing because of growth in medical schools, but funds allotted had not been increasing at the same rate.

He agreed with the assessment of the situation made by Senator Thompson that "it will really cripple our medical schools if something isn't done to get finances for them, for your research facilities", and shortage of staff.

Dr. Brown said the view of the MRC was that a science policy "is something that is multiple". He added that "one perhaps cannot have just one policy for science". The plea in the council's brief was for integration into the decision-making process....of men who know science, what is going on, what can be hoped for from science...".

The plea was not only for having science advisers like we have economic advisers, as Senator Lamontagne put it but also "to have an increased number of people who are not advisers at all in this specialized sense, but are senior administrators...who have had a degree in science and know this language and this method of thought..."

The Council's brief describes the organization of the council, its functions in relation to other agencies, review procedures, distribution of research support regionally, expenditures associated with scientific activities, how proposals are evaluated, research output and projects.

The brief sets out as hindrances to effective performance the temporary legislation under which the council operates; and inadequate secretariat, and inadequate funds. There are also nine case histories given. These range from studies on the mechanism of the action of hormones, bone metabolism, to the relationship between the adrenal cortical hormones and hypertensive cardiovascular diseases.

No. 31 - February 26th, 1969
Department of Indian Affairs and Northern Development

J.A. MacDonald, D.M., Department of Indian Affairs and Northern Development, told the Senate committee "we have a very great involvement in many areas of research on one kind or another".

The department is described as "a mosaic of activities and responsibilities". The Canadian Wildlife Service and the National Parks Branch have shown a strong research orientation. Mr. MacDonald said the former is "probably the centre of gravity for scientific research in the area in this country...probably within the world they are an outstanding service..."

Senator Belisle asked if it would be "true to assume that more effort has been deployed to wildlife service and the national historic parks branch than to the economic development of the north and to the scientific and technological problems regarding the resources of the north.?"

Mr. MacDonald pointed out that so far as the north was concerned "our responsibilities... are to stimulate, and to confine ourselves to direct stimulation of the industrial components to exploration". He told Senator Lamontagne, Chairman, that "we do very little research on our own".

The department has a northern research group and a northern coordination centre whose primary task was "not to undertake this research and re-invent the wheel on our own application, but to sustain, stimulate and to co-ordinate wherever possible research among other government departments and agencies within the government...and outside".

This had been done through coordinating committees and a program of university grants. A.J. Kerr, Chief, Northern Science Research group, said "our grants program to universities has been in essence undirected in so far as this department is concerned". The program began

.../3

as a result of a suggestion from the advisory committee on northern development, an inter-departmental, inter-disciplinary committee.

There were two important reasons for developing the north; its economic value, and "a sociological implication for the people who are living there". Creation of the educational system in the north had been "a small miracle in its own right".

The department is a "customer" for research-oriented departments. "We buy from the Department of Energy, Mines and Resources just like a province does at a pro-rata cost...".

No. 32 - February 27th, 1969
CIDA

The Canadian International Development Agency is the agency through which the Canadian government conducts its programs of assistance to the developing countries. There are three main components--the program of bilateral assistance, the multi-lateral program, and export credits of the Export Credits Insurance Corporation, now EDC.

As to the role of CIDA in the field of science and technology, M.F. Strong, President, said "we are not specifically designated as a scientific agency for purposes of government administration". But, he added, "I think it is apparent...that science and technology must and do figure very prominently in the requirements of the developing countries for assistance...". Almost every aspect of CIDA's program drew on Canadian scientific and technological resources and capabilities.

During the past two years the agency had undertaken a very intensive special series of studies on the specific role of science and technology in the developing world generally and more particularly "as it affects the role that Canada might play in meeting the needs of the developing countries".

Illustrative of this, the CIDA included with its brief a paper by Dr. Irving Brecher, Director of the Centre for Developing area studies at McGill University, and one by Dr. Geoffrey Oldham, Senior Research Fellow, Science Policy Research Unit, University of Sussex, England.

Mr. MacDonald said Canada 19 years after inception of the Colombo Plan was "just beginning now to have the kind of experience that is susceptible to meaningful research and we have provided in our own organization for special evaluation procedures". This involved much more in depth study of any proposition, whether it embraced science and technology or was a more simple operating type of proposition. Before undertaking projects, CIDA sent outside experts into the field to do detailed studies and investigation.

For example, the task force headed by Dean Bentley of the Department of Agriculture of the University of Alberta had made detailed recommendations after a visit to India which had formed the basis for an agreed program there.

Mr. Strong, stressed the point that it made good sense for Canada, with its limited resources, to do those things "which we are uniquely capable of doing well", and which have application at home.

He mentioned transportation as a field in which Canada had special experience. Another was the field of water resources; also insecticides and pesticides. "Even though the insects are different in the other countries, I gather that the basic science or the technology is similar".

The food industry in Canada had sponsored several programs that were designed to bring the secrets of food preservation, food distribution and food technology to the developing countries. There was "a tremendous need for this kind of thing"..in preserving, packaging, and utilizing local products. An example was a soft drink based on a protein soya bean.

Mr. Strong also mentioned the new International Development Centre. He told Senator

.../4

Lamontagne, Chairman, that there is nothing like this in the world at present. There was no single institution that was directed "specifically and solely at the application of science and technology to developing countries".

No. 33 - February 27th, 1969
CMHC

Sections 32 and 33 of the National Housing Act set out a wide range of research, information and development activities for which funds can be used by Central Mortgage and Housing Corporation.

W.H. Hignett, President of CMHC, said assistance given under Part V. Sections 31-33 includes assistance for advanced educational training and study, institutional support, and the distribution of information. Many of these activities involved "some scientific procedures and some scientific personnel".

There were four main categories of work done: community planning, housing design, building technology, housing and urban affairs. It was in building technology that CMHC worked closely with the division of building research of the National Research Council.

In the 1955 to 1968 period about 42 per cent of all funds had gone for institutional support; 31 per cent for training and education, and the remaining 27 per cent for research and development.

A new development had been the emergence of inter-disciplinary groups in centres of research at four universities--Montreal, Toronto, Waterloo and Manitoba. These centres were receiving support from CMHC.

"It was only comparatively recently that a closer relationship had developed with other government departments doing research related to areas of interest to CMHC. There was no increasing consultation, and support of research projects was shared with certain departments".

The corporation's fellowship program had grown to $700,000 for 90 fellowships--75 at Canadian universities and 15 outside Canada. This program covered a wide range of fields--from urban and regional planning to urban environmental health.

"The Canadian Council of Urban and Regional Research as one of its first tasks developed a catalogue of all of the urban and regional research done in Canada and outside".

Support is given by the corporation to projects of mutual interest undertaken by such agenices as the National House Builders Association, the Ontario Research Foundation, the Pulp and Paper Research Institute and the Atlantic Industrial Research Institute.

A patent has been taken out by Canadian Patents and Development Ltd. for the "Converto", an aerobic sewage disposal unit for individual households. Development work was done by the Ontario Research Foundation over a 10-year period with the assistance of CMHC grants. Production has been licenced to the Converto Company of Canada Limited.

Patents have been applied for by Reff Plastics Ltd., Weston, for a prefabricated fibreglass bathroom. Development of a prototype and moulds were assisted by a grant. Rights to production have been purchased by Crane of Canada Limited.

No. 34 - March 5th, 1969
Department of Finance

The focus of the committee's attention during the appearance of R.B. Bryce, Deputy Minister of Finance, was on the role of the Treasury Board as a science Policy decision maker, and the relation of the Department of Finance to it.

Mr. Bryce said "the essential controls are exercised by ministers". He added: "We exercise, I hope, influence and persuasion on those bodies that do exercise authority over

.../5

the others".

The Department of Finance was "the innovating department" insofar as taxes and tariffs were concerned. There were "the odd things" where it was the operating department, but these were the exceptions.

He later told the committee that the government looked at some general issues of science policy from time to time. The Department of Finance, for example, initiated the shift from the incentives given in the tax statute from research and development expenditures by industry to direct grants.

The central work on priorities now was done by a group of cabinet committees; for example, there is a cabinet committee on priorities and planning. In the work of appraising priorities, the Department of Finance took part as well as the Treasury Board Secretariat and the Cabinet Secretariat.

Decisions as to whether science should get more or less funds tended to be associated with particular programs. "We do know the general totals....; we know the scale or orders of magnitude of our scientific effort and the direction it is taking...."

Mr. Bryce told Senator Grosart that "I must take the view that the Cabinet Secretariat in the end" was the body which had to take responsibility for balance between expenditures within R and D.

Various kinds of research and development work help to contribute to productivity, to economic growth. "But unfortunately, they have got to be weighed up against other priorities for government funds....."

F.H. Leacey, Head, Economic and Analysis Division, explained the econometric model in use by the Department to forecast the gross national product, the employment rates, the unemployment rates, the price level. It helped estimate government revenues and government balances, and other critical policy variables as the level of foreign exchange reserves.

"The model is a mathematical description of the relationships that exist in the national accounts". The model tried to formalize inter-relationships between consumption and income.

In contrast with the one being developed by the Bank of Canada, it concentrated more on the tax effects on the economy. The bank's model was a more sensitive model, concentrating more on the financial effects on the economy.

Since the models were new and still liable to error, Mr. Leacey said "I am bringing the single equations from the econometric model into our traditional forecasting procedure on by one as single equations thoroughly tested and reliable. Then I bring them into our regular judgment forecast which is based on more traditional methods".

He described the "exogenous variables" that were put in from outside the model system. These consisted of government spending, exports, capital investment projections. When these were put into the model as data input the model would calculate total income developed, total employment developed. Then it would calculate the consumption function to estimate how much consumer spending would be out of total income.

The accuracy of past forecasts from year to year, Mr. Leacey said, had been usually within one or two points of the actual increase in GNP.

No. 35 - March 5th, 1969
Maurice Goldsmith, Science of Science, London, England

In the field of the laws of growth of science, or of the way in which scientists behave, "we know nothing at all", Maurice Goldsmith, Director, Science of Science Foundation, London England told the Senate Committee. "We know more about the moon than we do about science as

.../6

a social phenomenon".

Mr. Goldsmith explained that his foundation first began to operate in 1964. The science of science, he said, was concerned with "insuring that science no longer develops haphazar and uncontrolled". The growth of science up to now had been "the result of a rather promiscuous collusion between the practitioner of science, the educationist and the politician....". But the demands for improved productivity and trained manpower, for instance, had made it necessary to have centralized planning through a national science policy based on rational criteria for decision-making.

The "science of science" sought a rational account of the structure and behaviour of science. There was a need "to look internally at science as a discipline with its own history and logic...to determine whether there are laws of growth within science". If such laws could be found, "we shall be able to predict and use science wisely".

It was necessary to do research in such fields as the sociology of science and its history, the psychology of scientists and of creativity in scientific work, the flow of information, the popular communications of science, and operational research and the philosophy of planning. "We also have to study the role of science in different types of society, decision-making in national science policy, the economics of science, scientific advance, and the planning of research and development".

While it was true work was being done in some of these fields, "only a co-ordinated consideration of balanced interactions" would prove meaningful.

The Science of Science Foundation believed that science was one of the sub-cultures and that other sub-cultures such as the arts and humanities were equally important. This was recognized in the membership of the SSF Advisory Council.

As useful background for the discussion of national science policy in Canada, Mr. Goldsmith outlined "certain essential functions" of government in the allocation of resources in science as set down by the OECD committee in 1966. There were:=-inter-departmental co-ordination, long-term strategic planning, secretarial, statistical and other services, and co-ordination with educational and economic policies.

He also mentioned the book "Decision Making in National Science Policy" which contains the proceedings of the international symposium organized by SSF and the CIBA Foundation. It was now regarded as a basic text for those in Canada concerned with decision-making.

Mr. Goldsmith stressed that it was important to distinguish between objective findings of advisory bodies and the actual interpretation of this advice. The power of decision rested with a ministry of science of a minister for science policy or with the government as a whole. The final decision in the end must "inevitably be political".

He also said that there was no direct relationship between R & D and GNP. Some basic studies should be done in this field. "If innovation includes R & D, one has to look at the whole innovation spectrum and see what allocations require to be made. One of the things we require to look at is the extent to which basic research in itself requires to have money spent on it regardless".

No. 36 - March 6th, 1969
Treasury Board

In his second appearance before the Senate special committee on science policy, S. Simon Reisman, Secretary of the Treasury Board, described some of the Cabinet Committees that dealt with scientific activities.

One of these was "quite a new committee", the Priorities and Planning Committee of the Cabinet. This was the committee that made the decision on the ING project and the

.../7

recommendation to Cabinet not to proceed.

ING was also examined by the Treasury Board, then by Priorities and Planning, and then examined again by the full Cabinet.

He denied there had been a reversal of decision by the government with respect to the ING project. "There was no clean-cut recommendation on this from the Science Council . It was a recommendation that was hedged by a considerable number of qualifications...".

Mr. Reisman also reviewed the changes that had taken place in the role of the Privy Council Committee on Science and Industrial Research. This was established in 1916 under the National Research Council Act, and it met infrequently until recent years. With the establishment of the Science Secretariat it was decided that the head of the secretariat would be Chairman of "that supporting staff committee".

Mr. Reisman also reviewed the changes that had been made in the Science Secretariat, discussed cost-benefit analysis and its application. He said "I myself do not believe that the capabilities that have been built into departments and built into the Treasury Board in past years have been adequate to the task of adequately reviewing all the ongoing activities.."

No. 37 - March 6th, 1969
Post Office Department

The research and development division of the Post Office Department does research and development concerning post office equipment and new mechanical, electronic and electrical mail handling machinery. It also investigates and reports upon the suitability of various types of existing new equipment, on related materials and processes and it makes recommendations concerning their adoption.

This statement was made by H.D.W. Wethey, Director, Engineering Branch, before the committee. He also said the research and development division operates a research workshop for the production of prototypes..things like letter sorting cases or a bag rack.

Many of the questions from the Senate special committee on science policy concerned steps being taken to improve mail service. In response to a question from Senator Kinnear, Mr. Wethey said "we are quite familiar with what is being done in Britain. A great deal more mechanization and automation...can be done there because with their larger centres and larger volumes it is economical. We have in fact some of the elements....in Canada for the segregation and automatic facing up and cancelling of mail. We have sorting equipment for parcels, although not yet for letters".

C.F. Hobbs, Director General, planning and systems, mentioned the project at Toronto. Collection of data would tell the department "where the mail moves from outside the city and into it, and within the city". At the end of this year it was hoped to have "the location of new facilities identified on the grounds of economy and speed of transportation...."

R.D. Myers, Acting Director, Postal Service Branch, told the committee the Post Office was "going into the market research business" to look at the total picture, "to simply see where we can fit in and do the most efficient job...."

Mr. Wethey also told Senator Kinnear "we are unable to put in a large-scale letter sorting installation in Montreal and Toronto until such time as we have building properly designed to take them".

The new Ottawa Post Office building beside the Union Station in Alta Vista would not contain letter sorting equipment because the department was awaiting further development in the OCR--optical character reader. "We ourselves are not satisfied yet that the systems used in Britain and Australia, which involve an operating coding on an envelope with phosphorescent dots, the destination of the letter and the letter being scanned electronically, are the best for our purposes".

.../8

Mr. Wethey mentioned seven patents developed by the research and development division. Some of these had to do with handling pieces of mail at high speed. One had to do with a special lock for mail bags, another with a theft-proof mail receiver for the wall of a small post office.

In answer to questions from Senator Carter, Mr. Hobbs said "our money order system" ...was due to start next year. This would be in three parts with carbons between. "you would fill this in yourself, and the number of the office where you bought it will be imprinted on the money order by means of a machine that is rather like a cheque writer."

The brief of the department outlined the development of a plastic street letter box made from fibreglas reinforced plastic (polyester) in three basic parts using matched metal moulding techniques. Boxes went into use in 1965.

In 1967 a prototype of the slanted belt parcel sorter was designed, fabricated and installed in the Winnipeg Post Office. The concept originated in Australia, and was subject to modification by the British GOP.

The Pitney-Bowes Mark II facer canceller, in widespread use in the U.S. Post Office, was adopted after performance evaluation in 1966.

Also steel sorting cases for letter sorting has been developed with indicated savings in procurement costs of more than 50 per cent.

In operational research, the department uses econometric methods, computerized forecasting of manhours and mail volumes, statistical sampling and analysis techniques, and simulation and optimization. For example, a model for simulating the complete processing network of the internal workings of a Post Office is under development. Also under development is a model for optimizing the intra-city transportation and mass processing of mail.

No. 38 - March 12th, 1969
External Affairs

"Although the Department of External Affairs does not engage directly in any form of scientific research, the increasing extent to which science and related technological advances have assumed international dimensions, the multiplicity of international organizations concerned with scientific matters, and the complexity of problems created by rapid technological advances, has brought about important changes in traditional methods of approach to the conduct of foreign affairs".

The quotation is from the evidence of Marcel Cadieux, under-secretary of state for External Affairs. He said the department was "increasingly aware of the need to keep itself informed on a wide variety of scientific and technical matters, and also to ensure that it is organized so that it can rapidly and effectively deal with such problems".

Not only did the department have to keep in touch with broadly-based international organizations, but Canada had direct links with such bodies as the International Council for the Exploration of the Sea, and the World Meteorological Organization. Also scientific exchanges formed an important part"of our cultural agreements with France and the Soviet Union, and the Department also assisted in the conclusion of a scientific exchange agreement with Brazil last year".

Cited were such broad international interests of the department as disarmament, nuclear weapons and technology, the scientific programs sponsored by UNESCO, development of satellite technology, new problems in international law, and the role of science as a determinant of economic growth.

In the sphere of treaty negotiation, AECL has inter-agency agreements with national economic energy agencies in Italy, the USSR, Britain and France. In space, Canada has co-operated with Britain, France and Norway, as well as with the U.S., in the Alouette-ISIS Satellite Program to investigate the ionosphere.

.../9

He also mentioned that the department was considering setting up an office or division "which would have the responsibility for departmental co-ordination of scientific and technological aspects of Canada's external interest...It would also provide science-based departments with a central focus within the Department of External Affairs to which their enquiries might be directed".

Another area of interest was information storage. This related to the use of computer techniques...for the filing of information "which would tend to provide us with relevant background material to assist in the analysis of political developments and thus enable us to forecast with a greater degree of accuracy possible trends in international affairs".

In response to a question from Senator Aird, Mr. Cadieux said that as science became more important "in our national and international life I can well see that in the recruitment of people who will play a role in policy formulation ...that some background in science...may become essential...."

Asked about the input of scientific and technological information through the Department of External Affairs, Mr. Cadieux said the first step was to organize within Canada. In relations with Europe, the possibilities of exchanges of scientific information had been examined "very carefully".

The department's brief said "the department expects to be able, in consultation with the Science Secretariat, to provide scientific attaches in accordance with the quality and quantity of the demand for such services...."

No. 39 - March 29th, 1969
Vickers et al.

Includes presentations by Sir Geoffrey Vickers, of England; Professor Eric Twist, Professor of organizational behaviour and ecology, Graduate School of Business Administration, University of California, Los Angeles; Professor Robin F. Badgley, Director, Behavioural sciences, Faculty of Medicine, University of Toronto; Francis G. Bregha, associate professor, School of Social Work, University of Toronto; and James Ham, Dean, Faculty of Applied Science and Engineering, University of Toronto.

Sir Geoffrey Vickers felt that the resources of science would become increasingly harnessed to the understanding of "the increasingly complex human systems" which characterize society. This had a bearing on the question of whether organizational and departmental science was to be regarded as linked to education or to technology.

Linked with the business of organization was the way in which "statistics of the research effort are...carved up". It might be that so-called "operational research" would have to be distinguished. The means for deducing differences of policy within a single department were "very much greater" than those available for determining differences which crossed departmental boundaries.

He also referred to the role of public policy in science budgeting. It was "increasingly important that the direction of science effort and the field of the effort be more and more responsible to public policy". It was just as important that the scientific community be responsive to public policy as that the political power should be responsive to scientific need.

As to the institutions in which science would be done in the future, he said his feeling was "that...extra-university science will grow, and that it should grow". He envisaged science being done in two types of institutions: non-University bodies, largely dependent for their revenues on contracts; and a university set-up concerned with education and the pursuit of knowledge. But the universities would be much more concerned with "the need to focus on and to be responsive to contemporary problems". The time has come when priorities in seeking new knowledge would have to become more responsive to human concerns. And this meant there would have to be "some spontaneous, not necessarily formal, direction to the way in which knowledge was sought".

.../10

Professor Eric Twist said the medium and smaller advanced countries had to be "science-based societies". To be able to choose between a "set of possible futures", such countries had to be "much more flexible, innovative and adaptive". The other reasons for being science-based was economic. He envisaged "a tough struggle ahead...to keep our distinctive competencies alive and growing".

But the whole chain of science to innovation was of "supreme importance". Professor Twist said two kinds of innovation go together: the innovation and adaptive capability towards the future, and the innovation required "to keep us going..."

He asked how many centres of excellence Canada can have in various areas of science, including the social sciences. The time was past when "one can think of having all the resources...in one place...but you can have centres of excellence...in various places".

Harking back to Sir Geoffrey's point about the new field of investigating complex problems, Professor Twist said "I have called these areas 'domains' because they join the concern of a society and the concern of sciences together in a big area of investigation...." These were really ecological problems.

The decision-making structure, he suggested, for opening up these domains was different from the familiar decision-making structures in science. Users of science, were the dominating group in the decisions,scientists were really working in their interests in contrast with the pursuit of pure knowledge---but in "these complex problems they are joined together in a different way".

The insights, resetting of the problems, the perception of them had to grow up between the political leaders, the administrators, the representatives of industry and labor, and the scientists. It was necessary to build groups of people who would perceive the structure of these domain problems.

As to organization forms, Professor Twist suggested three basic patterns "which have institutional consequences". Type A was centres of professional social science activity with associated research and development establishments. These were profession-based and linked to user interests. They could be located in government departments or in consultant groups. An example was the Organization for Social and Technical Innovation in the U.S.

Type B was centres of basic research associated with universities but in autonomous departments based on a discipline of knowledge, and undertaking both graduate and undergraduate training. Here was found the research-teaching mix.

Type C was represented by centres of applied research--domain-based research--associated with advanced research training. They were the necessary link between user organizations and universities concerned with basic research, located within the boundaries of universities, university centres and institutes, or outside of them. Interdisciplinary in nature, these centres accepted professional as well as scientific responsibility for the projects they undertook. This was the research-application mix.

Professor Twist made the point that in the social sciences the relation of theory and practice, pure and applied, as compared with the natural sciences was "fundamentally different". He elaborated "in the sciences of man we cannot and would not experiment very much". On the whole, in the social sciences, it was necessary "to reach the data in their natural settings in society" in contrast with the natural sciences which seek "to extract the problem out of its setting in nature".

"The social engagement of the social scientists" represented "a strategy for advancing the base of fundamental knowledge in these sciences".. the right to dialogue with political leaders, business and labor leaders had to be earned.

Professor Robin F. Badgley, dealt with two or three highlights. On the specific structure of science policy, four recommendations emerged. One was that at the national level

.../11

a broadly representative committee be established to represent the public and all scientific disciplines.

Secondly, it was recommended that scientists in increasing numbers be added to government departments. The third point made was that government advisory panels from various backgrounds should work closely together. Finally, it was recommended that the public be represented on each of these committees.

Other recommendations concerned broader inter-disciplinary involvement in basic teaching programs of all scientific backgrounds, and greater emphasis to training and research in various social sciences.

No. 40 - April 23rd, 1969
Regional Economic Expansion

The Canada Land Inventory and the supporting Geographic Information System of the Department of Regional Economic Expansion has aroused international interest the Senate Committee was told.

The Canada Land Inventory is a land classification system. The federal government approved the undertaking, under ARDA, of a comprehensive land resource inventory in 1963. But in addition to agricultural capability studies, the federal government agreed to give financial backing to the provinces for programs of land capability for forestry, recreation, and wildlife. Land use mapping was also undertaken.

Two scales of maps were chosen--one to 50,000 or close to one mile to the inch for the base maps, and one to 250,000 for publication. It was envisaged that the program would result in about 20,000 maps at the larger scale and 1,000 at the smaller scale. To make this mass of data readily available and manageable for multiple comparisons, it was necessary to desig a computerized system to convert mapped data into digitized information on tape. The Geo-Information System, unique in the world, was developed for this purpose.

The System accepts and stores all types of location-specific information--any that can be related to an area, line or point on a map. Information relating to land resources, the department's brief said, is most frequently location-specific in character. Examples are:- census data, a highway(a location-specific line), or a campsite (a location-specific point on a map).

The system comprises two parts: the data bank and the information system. For maps at a scale of one to 50,000, it is expected that a complete coverage of the farmed area of Canada (about 600 map sheets) can be recorded on two reels of magnetic tape.

A major capability of the system is the ability to compare two types of mapped data relating to the same area. For example, a request to find suitable landing sites for a helicopter would require an examination of the vegetation map to determine treeless areas, the topographic map, and the present land use map to make sure the area was not populated. The system can also carry out a "search in context", a "nearest neighbor search", and can produce information in two different forms--that of a regular computer printer and a graphic plotter.

Andre Saumier, assistant deputy minister(programming), explained the administrative responsibility of the new department. i.e. the responsibility for ARDA "is now diffused within the whole department". The NewStart Program, formerly an administrative section of the Department of Manpower and Immigration, has now been absorbed. The Atlantic Development Board Act had been repealed and the Prairie Farm Rehabilitation Act was still in force. But "from the administrative point of view all of these various groups have been molded into the new department".

The new department, Mr. Saumier said, was not a research department, but "an action department". Hence, the test that had to be applied to any research project was "what is the bearing...on certain problems we have to solve now or in the near future". However, the

.../12

department had to be in a position to anticipate problems--and research might be required "on a broad area basis".

The Customs and Excise division of the Department of National Revenue maintains a laboratory engaged in chemical analysis. The function of the laboratory is to examine and identify a variety of chemical commodities to provide scientific information as to composition sufficient to permit classification in the Customs Tariff or for administrative purposes.

Examples of projects carried out include support for Tariff Board Report TR-120 which recommended introduction into the Customs Tariff of a completely new schedule for chemicals, chemical preparations and plastics.

An example of applied research was the work done on the butadiene content of styrene-butadiene copolymers. The laboratory developed a method of determining by infrared spectroscopy the per cent by weight of styrene or butadiene.

There is also an excise tax R & D division. Its task is to plan measures to improve the administrative feasibility and the economic neutrality of the Excise Tax Act and the various administrative instructions issued by the department under this act.

The brief submitted by Brydon Smith, curator of contemporary art of the National Gallery of Canada dealt with "the interrelationships between some contemporary artists' visions and the potential of science and technology to realize them, and the human value and meaning some artists can give to the impersonalizing tendencies of science and technology".

The brief termed "disappointing" the projects realized by the Canada Council sponsored Intermedia in Vancouver and Experiments in Art and Technology, a private foundation in New York City. It cited the work of American artists, Robert Morris and Dan Flavin, who are independently using available technology "to humanize and beautify existing spaces".

A brief was also submitted by the Crime Detection Laboratories of the R.C.M.P.. It pointed out that there was "an urgent need for continuous research and development work in the forensic sciences".

It recommended establishment of an Associate Committee of the National Research Council to advise the commissioner, and through him, other interested Canadian policy departments... on the scientific aspects of research. It also recommended setting up "a high-level central research establishment within the RCMP headquarters organization at Ottawa to conduct R & D in the field of forensic sciences and police equipment.

Also urged was federal government assistance to enable one or two Canadian universities to establish departments of forensic medicine and forensic science at the graduate level. But there was "a very close relationships between the recommendation for establishing a central research establishment and university graduate schools..."

Untramural research projects are selected on the basis of whether it will be "of significant advantage to develop analytical methods which are more sensitive, more specific, faster, and quantitatively more accurate than present procedures". Also, procedures developed for basic research techniques reported in industrial and other research laboratories are investigated to determine possible forensic applications.

The laboratories have carried out basic research into correlation of blood alcohol levels and impairment of driving ability. Development activity has been concerned with the effects of certain "extremely potent drugs", such as LSD. "This remarkable potency, wherein 50 to 70 micrograms of LSD, when ingested, can cause a 'trip' of considerable proportions, required the chemical analysts to devise extremely sensitive analytical techniques...to identify LSD and related compounds with certainty".

The brief submitted by the National Museum of Natural Sciences stressed that "there is an urgent need to develop a national policy in museum research in the natural sciences".

.../13

Resources were limited for development in both manpower and collections. The brief also said national collections in botany, zoology, mineralogy and palaeontology must be enlarged "to provide research facilities for visiting scientists and university students as well as to provide strong core collections" from which loans could be made.

No. 41 - April 24th, 1969
Canada Council

National goals will not help define governments' roles as entrepreneurs since these roles "must find their justification in their acceptance as social objectives in themselves". The Canada Council brief went on to say that unless this distinction was made, governments' interest in science "could become ambiguous". "It might come to lie merely in the buying of time while a political consensus develops, rather than in the need for expert advice. What the natural sciences, could contribute further to the understanding of pollution may well not be what governments require to take action".

The brief also pointed to the danger of governments to respond to political pressures at the expense of "free research". It was a good thing for scholars to have access to multiple sources of support but departments which needed research should buy it "and not set themselves up as patrons".

It was questioned whether departments needed to offer special fellowships in the social sciences beyond those offered by the Canada Council, and whether they needed to offer special research grants beyond their own research contracts and the Canada Council. The brief also discussed screening procedures, the use of a pre-audit system, and cost-benefit analysis--recognizing that university research must include scientific as well as social benefits.

The brief asked "how will governments choose between the cost-benefits of enabling measures and those of protective and remedial measures?"

In the area of support for the social sciences and humanities, the brief noted that the position of natural scientists had improved considerably, while the Canada Council could support only 10 per cent of its universe of career scholars. On the other hand, two out of three natural scientists were being supported.

It was pointed out that unless the Canada Council budget was doubled over the next two to three years, there was "a grave risk" that the expectations of its research community would be dashed again.

The brief also commented on the Treasury Board's Planning-Programming-Budgeting. It cautioned that if Canadians wanted to know how much they should spend on science, "they must be prepared to take an entirely fresh look at the way they have been spending money in the discharge of other government functions in the past several decades". But PPB "should offer choices not only within programs but also between programs".

On the question of whether Canada should have a Minister of Science, the Council said it was "difficult to see how a single minister could discharge a promotional and co-ordinative role" if the sciences--especially the social sciences--were to become instruments to achieve broad national goals. On the other hand, a good case could be made for a single minister having responsibility for all programs in aid of university research, including the national information services of the National Library.

It was by no means industry alone that must develop a sense for using the fruits of science, the brief said in commenting on incentives for industrial research. "More and more it is other national institutions, such as unidersities, hospitals, mass media...it is quite possible that there would be even greater industrial innovation if science were more responsive to the needs of all service institutions..."

The same thing could be said of technology. A good deal of it resulted from research done in the social sciences.

.../14

Still greater use, the brief said, must be made of the social sciences by all governmental bodies engaged in the study of problems of science policy. Not only was the question of the social usefulness of work done in the natural sciences a socio-economic problem, but so was the question of planning, costing and staging programs of research aid.

A decision on the advisability of establishing a national social science institute would have to take into account the limited availability of top Canadian scholars in the field, and the effect this would have on present programs and plans of Canadian universities. The most promising solution would be the provision by the government of exceptional facilities where the best researchers might spend various period of time, on leave, on free research, a good deal of which could be interdisciplinary.

Jean Boucher, Director of the Canada Council, defined "free research" in these terms. He said this was "the kind of research that is freely initiated by scholars and scientists operating outside the government circle".

Dr. David W. Salter, Member of the Council and Dean of the School of Graduate Studies at Queen's University, gave a number of illustrations of fields in the social sciences being supported by the Canada Council. One was in the training of quantitative economists--a group that would play a major role in sorting out economic policies and in the development of econometric models and their application in government and business. Another field was support of non-numeric computing.

He also told the committee he did not believe sociology "will be effective in action" unless it has a solid core based on scientific and scholarly work. The quantitative methods made possible by computer technology might be "the salvation of sociology".

DIGEST OF THE PROCEEDINGS OF THE SENATE COMMITTEE
ON SCIENCE POLICY

Fourth of Four Parts - (Reports No. 42 - 77)

No. 42 - April 30th, 1969
Department of Industry, Trade and Commerce

This volume contains briefs submitted by the Dept. of Industry, Trade and Commerce, the Department of Public Works, the Emergency Measures Organization, the Dominion Coal Board, the Library of Parliament, the Public Archives, and the St. Lawrence Seaway Authority.

J.H. Warren, D.M., Industry, Trade and Commerce, summarized the duties of the dept. which have a particular bearing on science and research. These included assisting manufacturing and processing industries to adapt to changes in technology; to assist them to rationalize and restructure; to promote and assist product and process development and increased productivity.

The last named function involved application of advanced technology and modern management techniques, modernization of equipment, the utilization of improved industrial design and the development and application of sound industrial standards in Canada and in world trade.

Recent studies indicated that increases in productivity resulting "to a great extent from new technology" had been a major factor in the spectacular economic growth in the U.S. over the past 50 years. Mr. Warren also noted that "many authorities in Canada, over the past few years, had urged that more government sponsored development activity should take place in Canadian industry".

He described the five programs being administered by the department to provide financial assistance for industrial research, development and innovation. These were PAIT, DIP, IRDIA, BEAM and the Industrial Research Institutes Program.

The objective of the BEAM program is to increase productivity and efficiency in the manufacture and use of building equipment, accessories and materials. The department has taken the initiative in designing an information system for the dissemination of such knowledge.

The Industrial Research Institutes Program provides grants to universities to help cover administrative expenses of institutes they set up to work with industry. In particular, the institutes are intended to undertake, on a contract basis, scientific research activity for industrial firms unable to maintain their own research facilities.

In addition, the department carries on continuing studies of the scientific and technical policies of government departments and agencies at home and abroad; has initiated a series of techno-economic surveys of sectors of industry; carries on technological forecasting studies, and has taken a strong interest in setting up a scientific and technical information service.

Mr. Warren told the committee that the department had its Office of Science and Technology "trying to monitor what is happening in the world outside Canada as well as inside Canada". This office is staffed by a group of scientists and engineers who are specialists in the fields of industrial chemicals and pharmaceuticals, polymer chemistry and foods, textile technology, metal technology, mechanical engineering and production processes, transportation technology, power systems, communication systems, computer and control systems, and electrical and electronics technology.

The department has employed outside consultants on such projects as the R & D needs of the Canadian furniture industry; information on optimum household furniture and manufacturing facilities; the major appliance industry, its performance and international competitiveness; aerospace activity in Canada, and assessment of the satellite communications market, 1970-80.

The Dept. of Public Works brief outlines research oriented projects for the period

.../2

1962 to 1967. These included a Littoral Drift Survey on the Great Lakes to develop a means of reducing sediment deposition in harbor entrances (this was a joint project); investigation of the erosive effects of ship generated waves in the St. Lawrence; study of the performance of floating breakwaters, and a wave climate study. These projects come under the Marine Engineering Division.

E.M.O. requires scientific support and research in three main areas. These are:- determining probable direct physical effects of modern weapons and weapon systems; indirect effects of attack upon the various systems and components, and the examination of options in passive defence. The Defence Research Board continues to provide a broad base of scientific support for Canada EMO.

There is also a small unassigned research co-ordination fund to be used on an opportunity basis to initiate research programs. This is administered by the office of the scientific advise This office also administers a fellowship program at the Ohio State Disaster Research Centre. A $5,000 a year three-year award is made each year to an MSc. level Canadian sociologist.

The Dominion Coal Board's policy has been to make use of existing federal research laboratories. It has also attempted to encourage the development of provincial "centres of knowledge". The board's assistance has been on a modest scale, amounting in total to $50,000 per year, distributed among approved recipients. The board is now being dissolved.

In its brief the Library of Parliament asked for new facilities on Parliament Hill or adjacent to it, for higher salaried research officers of "graduate faculty calibre", better liaison in information services, and a greater rationalization of federal government expenditures on library information.

The Public Archives of Canada in its brief said "the acquisition of material which provides the basis for research, the classification and preparation of finding aids which makes it accessible, and the provision of reference and research facilities can be considered as essential support for research in history, political science and other disciplines".

Circulation of material, written inquiries, interlibrary loans of microfilm, orders for photoduplication and other aspects of research have been increasing at a rate up to 50 per cent annually.

The St. Lawrence Seaway Authority has three branches involved to some degree in scientific activities. These activities are all confined to the St. Lawrence Seaway System which extends from Montreal to Lake Erie. Over the past five years, investigations have been made into the canal system capacity and the development of means of optimizing canal operations on both the Welland and Montreal-Lake Ontario sections of the seaway.

The three branches involved in research are the construction branch, the economics and research branch, and the engineering branch. In the 1968-69 fiscal year total expenditures on scientific activities were $1,556,800 compared with $2,653,400 in the previous fiscal year.

No. 43 - May 21st, 1969

Dr. John MacDonald, Executive Vice-President to the President of Universities of Ontario.

Study began two years ago under the sponsorship of the Science Council and the Canada Council. Terms of reference were to examine the present level sources and conditions of federal support and the purposes, principles, policies, organization and management, which will serve to improve the quality of research in the universities through the efforts of the federal support program. The principal theme of research in universities is an enterprise involving three principal partners: the federal Government provinces and the universities.

The provinces, provide direct support for universities, as educational institutions and they are reimbursed for 50 per cent of the ordinary expenditures through the federal fiscal arrangement.

.../3

The Federal Government has two main interests. (1) is that the Federal Government itself have an interest in strong universities in Canada as a goal in itself.

(2) is in the procurement of research which relates to the other goals of the Federal Government - in industry, fisheries, agriculture, health.

All disciplines within the universities should be eligible for support through the councils. The Federal Government should pay the indirect costs of the research which it supports. There could very well be a role for the federal Government in the provision of buildings for research. A federal-provincial conference should be to consider the establishment of a research facilities corporation which would allocate funds to universities on the basis of application and merit. The home of most basic research we believe should be in the universities, but additional roles for the university would be in the areas of applied research. The role for the universities is also in production of manpower.

The Industrial sector in relation to universities and research in universities? - was not included in terms of reference. Some discussion between Dr. MacDonald and Senator Grosart about "political" money and "political" control followed.

No special brief was held for the three councils (Science, Medical and Nation Research). Evidence seemed to indicate one thing: scientists want scientific control of the decision-making, but politicians are forced by the existing system and their responsibility to the public to insist on maintaining control.

A division of these two goals of the Federal Government was suggested (1) the goal of supporting research in universities per se, (2) goal of conducting research which relates to other purposes of the federal Government.

Directly or indirectly, NRC, as it exists at the moment, should be eliminated - directly because they would cease to give grants to universities, and indirectly because the Government should reconsider the status of all its research labs. This is <u>not</u> viewed as being the elimination of the N.R.C.

We see an increasing divergence in the function of the N.R.C. (1) a divergence between the function of supporting university research, (2) the desire of the council to have its laboratories revitalized.

<u>No. 44 - May 27th, 1969</u>
Association of Universities and Colleges of Canada.

Institutions of higher education have two primary functions: teaching and research. The Federal Government is urged to adopt a policy of establishing government research laboratorie on university campuses, and in such circumstances, the university be given adequate means to strengthen the related departments and at the same time support R & D at small universities.

Emphasis should be placed on the vast increase in the research requirements of the biological sciences that will take place during the next decade. The AUCC, in close cooperation with the Social Science Research Council of Canada and with the assistance of the Canada Council, establish a Committee to study the feasibility of the creation of an inter-university agency which would have the following functions: (a) the organization of a social science data-bank, (b) the provision of appropriate services to facilitate survey research.

The AUCC recommends that a liaison committee advisory to a Minister of the Crown, with representation from the Department of the Secretary of State, The National Research Council, Defence Research Board, Medical Research Council, Canada Council, Science Council, The Science Secretariat be formed. This committee would help the granting agencies and related advisory bodies to develop policies, relating to the support of research in the universities of Canada. The AUCC urges agencies which provide research funds to universities to include in their grants the full supporting costs of the research.

.../4

No. 45 - May 27th, 1969
SAINT FRANCIS XAVIER UNIVERSITY

The Universities should be responsible for the greater part of the fundamental research that is basic to all R & D and also for a substantial amount of the applied research that flows from it. Substantial annual basic grants for research to each University should be made. Additional funds through a national granting agency for special projects such as Centers of Excellence, Outstanding Scientists, Large Installations, etc. should be provided.

MEMORIAL UNIVERSITY OF NEWFOUNDLAND

Major development grants should be made available in the humanities and social sciences. Regional bibliographical centres and regional data banks serving a number of universities and other research centres through sophisticated electronic and inter-library loan services should be established. In the development of a supplementary programme aimed at increasing regional equality, all universities should be encouraged to supply a five-year projection of their research activities. Responsibility for the support of research carries with it the responsibility for support of the indirect costs. For contract research the contractor should pay the entire cost, including indirect costs. New linkages should be created between federal and provincial governments, between the Canada Council and the N.R.C., and between universities, government departments and government research institutions. Visiting committees should be appointed by the National Research Council, the Canada Council and be sent from time to time to review research activities being conducted in universities receiving Federal research support. A continuation of the present procedures for assessing the merits of applications for negotiated development grants is recommended.

SCIENCE FACULTY SAINT MARY'S UNIVERSITY HALIFAX, NOVA SCOTIA

The National Research Council be the major granting agency for federal financial assistance to university research but that selection committees be broadened to include humanists economists, and industrialists. A National Science Policy stressing the use of science should include assistance to undergraduate science teaching and encourage the growth of the "knowledge industry" including R & D companies. Also a greater effort should be made to encourage R & D in regions where the level of economic activity is below the national standard as a means of encouraging economic growth through mission oriented R & D.

DALHOUSIE UNIVERSITY

A mechanism be established for planning of scientific work, in its research, educational and applied aspects on a national basis. The agency responsible for this planning should draw upon the whole scientific community rather than solely from that part of the community responsible for the funding of science. The planning process should be concerned with available human and material resources within Canada. The result of this planning should be the creation of an areas of excellence for Canada.

There is a necessity for a central authority to which both the planning and the co-ordinating groups should report. Development of effective communication systems is perhaps the single most important element of a useful science policy.

The flow of information between university, government and industrial sectors of the scientific community has been poor. Financial support of research in the pure sciences must be continued and strengthened rather than withdrawn in favour of "mission oriented" efforts.

Programmes for the planned support of new research facilities should be introduced. To make effective use of expensive facilities, university staff must be prepared to enter into liaison with scientists in the government and industrial sectors of the community. The development of regional centres of excellence, in which universities, government and industry would all participate, is an obvious kind of liaison which deserves further study.

.../5

ACADIA UNIVERSITY

There appears to be a relative lack of interaction and communication between scientists in university and those in industry. Some remedies suggested for this situation include the so-called "sandwich or work-study" system of which the best known example in Canada may be that of the Faculty of Engineering at the University of Waterloo.

There is a great need for planning, cooperation, and coordination in the provision of facilities for relatively expensive professional or other faculties on a regional basis.

An increasing involvement of the federal government in the financial support of higher education is essential. The thesis that research resources should be concentrated in a relatively small number of large institutions should be questioned. Comparable advances to those in science and technology must be made in the humanities and social sciences.

UNIVERSITY OF NEW BRUNSWICK - FACULTY OF SCIENCE

The quality of university scientific research is high while the contribution of university scientists to scientific knowledge is substantial and has been made at modest cost. Only by increasing the number and quality of graduate students can Canada continue to improve standards of education, government and research at all levels.

As it is impossible to predict which basic research will have useful application at a later time, so the continued investigation of basic problems in universities is utterly vital and invaluable to research in its broadest sense and to the eventual success of applied research.

It is vital to our national cause to possess and continually increase the body of research scientists not only for their productive capacity and output of new knowledge, but also for their expertise and technical know-how. This body is the only one available to focus on any problem, fundamental or technical, of national concern.

No. 46 - May 28th, 1969

The joint brief submitted by Laval University, the University of Montreal and the University of Sherbrooke suggested national science policy should recognize "the cultural and regional plurality of Canadian society".

As Dr. Maurice L'Abbe, vice-rector (research), U. of M. expounded this thesis, "any national scientific policy should take into account the two dimensions of our society, the one being the pluralist nature of this society, the other, the specific nature of its economy". He added that"the cultural plurality...implies that an overall science policy will not oppose or alter policies which each Canadian cultural community might adopt".

But he also distinguished another aspect of this "pluralism"--regional disparities.

Any national science policy also had to recognize the limitations of economic resources, designate areas of special concern, aim at exchanges of researchers and information between universities and federal and provincial government agencies, and develop inter-disciplinary research, and ensure industry participation in R & D programs.

The brief also said that machinery for granting research subsidies and the make-up of federal research agencies should be revised. This was proposed "in order to take account of the availability of willingness of the French-language universities to participate in scientific growth".

Dr. L'Abbe noted that "the major Quebec universities have attained standards and a development in several areas whereby they compare favourably with their English counterparts

.../6

in the rest of Canada". Yet until recently federal grants had been made on an individual basis with the result that the French-speaking universities in Quebec "faired poorly because they had fewer researchers". Moreover, federal research institutions had been located across the country in "an English milieu", and federal organizations had been so composed that "to some extent" they were controlled by English Canadians.

Dr. S.B. Frost, Dean of the Faculty of graduate studies and research, McGill University, emphasized the importance of graduate studies in the humanities and social sciences--in addition to the sciences. He recalled McGill had supported formation of a social sciences and humanities council.

There was need for a national policy with regard to libraries. In this connection "the main tendencies of the Macdonald recommendations" were "along the correct lines". And indirect costs of research should be borne by federal funds.

Dr. Frost also put forth McGill's view that "research directed towards national objectives or mission-oriented research is not comparable with the research activities of universities...We believe that pure research will not disappear from the universities, and ...we think that there is more need than formerly to have a federal agency which identifies and defines those national objectives with regard to which mission-oriented research should be instituted".

He also went on record "that we would not want to see the research laboratories of the National Research Council divorced from the Research Council itself". Any awarding body needed to be engaged itself in research.

Professor H.M.M. Dutton, Head of the Physics Department, Bishop's University, said Bishop's would not be in favour of concentration of research at "centres of excellence". The number of people in honors programs at Bishop's was "relatively very high", and a number of them went on to graduate schools all over the country. "We think," Prof. Dutton said, "that is necessary to support research at places like Bishop's".

Dr. D.J. McDougall, Chairman, Geotechnical Sciences Department, Loyola College, said Loyola had a real problem in finding salaries for research assistants and research technicians. While the college had no graduate students, for some of the better undergraduate students it had a program in geology, physics and chemistry whereby they were expected to do a certain amount of research. There was also a fairly active research program among professors.

It was also suggested that consideration be given to groups of researchers who would be able to employ technicians or assistants "on a long-term, probably pooled, basis..."

Some sort of co-ordination between universities on research projects to prevent duplication was urged by Dr. J.R. Ufford, assistant dean of science at Sir George Williams University. But this co-ordination "should be set up in such a way that there is no block to the development of the newer universities".

A second area of concern was the decreasing employment possibilities for science students "We would also like to see the universities turn more attention to applied research..." Dr. Ufford said.

No. 47 - May 28th, 1969

YORK UNIVERSITY, Toronto (Faculty of Science)

Start 2 or 3 year funding of projects. Government laboratories should have clearly defined missions. Encourage development of small "idea" firms. Resist any move to divert to the provinces the responsibility for funding research. One science body should administer federal support.

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LAKEHEAD UNIVERSITY, Thunder Bay (John Hart)

Modify granting procedures in order to facilitate interdisciplinary work.

UNIVERSITY OF WATERLOO, Waterloo

Universities should be encouraged to assume more responsibility for research generated by problem recognition. Need more inter-institutional cooperation and coordination. Study long-term requirements of industry for continuing post-experience education.

UNIVERSITY OF TORONTO, Toronto

Federal government must remain primary sponsor of research in universities. Extend terms of grant from one year to three years. Each grant should have a supplement of 30% to cover portion of indirect costs. Major scientific projects should be placed near to universities interested in their use.

SAINT PAUL UNIVERSITY, Ottawa

More support to research libraries.

QUEEN'S UNIVERSITY, Department of Physiology, Kingston

Need a realistic program of support for medical research.

McMASTER UNIVERSITY, Department of Religion, Hamilton

Broad government support of science in universities is desirable, but governmental control is not. Undergrads majoring in science should not be permitted to neglect the more philosophical subjects.

LAURENTIAN UNIVERSITY, Sudbury

Government should foster a policy of coordination of scientific information.

UNIVERSITY OF GUELPH, Research Advisory Board, Guelph

Government should establish a body to develop, maintain and constantly review national research policy. Areas of research should be those most likely to increase the GNP. Consolidate research by keeping only units large enough to be viable.

CARLETON UNIVERSITY, Faculty of Arts, Ottawa

Establish research institutes where academics and others could concentrate on inter-disciplinary approaches to solutions of problems. Government should expand its extramural programs to include universities.

UNIVERSITY OF WESTERN ONTARIO, Department of Computer Science, London

Implement science policy objectives by a Cabinet-level department on science and technology.

CARLETON UNIVERSITY, Faculty of Engineering, Ottawa

Base national science policy upon the application of science as this can help people to take an interest through their ability to relate to most applied science projects.

NOTRE DAME UNIVERSITY, Nelson, B.C. (J.F. Oistma)

Form an effective planning and coordinating body between government, industry, university on research.

UNIVERSITY OF BRITISH COLUMBIA, Vancouver (F.A. Forward)

In supporting research and graduate studies, federal government policy should allocate funds directly to universities for capital purposes. Form more national advisory committees to advise government in formulating research programs.

UNIVERSITY OF MANITOBA, Winnipeg (H.E. Duckworth)

Properly emphasize versatility of graduate study and encourage graduating students to exercise their competence without restrictions to their fields, in order that graduate training in universities could contribute more than now to national aims.

UNIVERSITY OF LETHBRIDGE, Lethbridge

There should be support for many small and medium sized research projects, rather than support for a much smaller number of very large projects.

UNIVERSITY OF ALBERTA, Edmonton (A.G. McCalla)

Study research capabilities of industry. Individual research should be complemented by development of multi-disciplinary projects.

UNIVERSITY OF SASKATCHEWAN, Region Department of Geological Sciences (W.A. Gordon)

Require a more rapid means of information. Greater national and regional efforts needed to improve science teaching from kindergarten up. Need more support of undergraduate science in earlier years.

UNIVERSITY OF SASKATCHEWAN, Faculty of Administration, Regina, (A.B. Van Cleave)

Need more coordination and communication as to what has, is, or might happen in science.

UNIVERSITY OF SASKATCHEWAN, Saskatoon (J.W.T. Spinks)

Government should promote more effective coordination. Establish a health science research council reporting direct to a Minister.

UNIVERSITY OF CALGARY, Calgary (J.B. Hyne)

Establish centres of regional excellence and define the factors needed to decide on their location.

J.B. MITCHELL JUNIOR HIGH SCHOOL, Grade 8 Students, Winnipeg

Teach science in an up-to-date way by use of pamphlets or science papers.

UNIVERSITY OF SASKATCHEWAN, Saskatoon (B.W. Currie)

Recognize local problems with some economic implications; initiate research on it; apply the results.

Recommend 35% increase in federal funds for university research and programs for 1970-71. For each field of study there should be one federal agency to which university staff could apply for pure research support. Any Ministry of Science Policy should have no operational responsibility for administering research grants.

No. 50 - June 3rd, 1969

This report contains the briefs of the Research Council of Alberta, the Saskatchewan Research Council, the Ontario Research Foundation, and the British Columbia Research Council.

Dr. E.J. Wiggins, Director of the Research Council of Alberta, told the committee that the provincial research organizations had "some special contributions to make", particularly with "their strong technological orientation as contrasted..with the more basic scientific interest of the other Canadian research groups, their flexible, interdisciplinary style of organization, their close contacts with private industry and their familiarity with the important problems and characteristics of each region of Canada".

Dr. Wiggins recommended that (1) the provincial research organizations be recognized as a vital factor in the Canadian research scene, and that any necessary studies and programs be initiated at the national level to take full advantage of their capabilities". (2) that there be improved communication between federal and provincial research agencies.

He said "We would like to see more decentralization and regional adaptation of federal research programs". An effective way of achieving such decentralization would be "to take advantage of local talent by contracting out... the federal research requirements". All such contracts would be open on an equal basis for bids from all qualified research groups. The complete removal "of any arbitary barriers" to co-operation and to funding between federal and provincial agencies was adviseable.

Dr. T.P. Pepper, Assistant Director, Saskatchewan Research Council, stressed the need for a special study on the interaction of federal-provincial science activities, "with particular attention to support of research and implementation in areas involving those resources falling within provincial jurisdiction".

Regional or provincial agencies should be expected to bear considerable responsibility for the national effort applied to regional problems. i.e. the Saskatchewan Council had first-hand experience with research into groundwater resources in the province.

And Dr. Pepper's last point was that provincial research agencies should be just as eligible as industry and universities for winning contracts and grants for goal-oriented research and development.

The New Brunswick Research and Productivity Council's primary concern was "to offer industry the maximum scientific and engineering assistance at cost to increase its profitability and productivity".

Dr. Blanchard, President-Nova Scotia Research Council said "our activities are much more in the field of technology than science and our laboratory facilities are organized to solve local problems".

W.R. Stadelman, President of the Ontario Research Foundation, pointed out that during the past five years the ORF had played a leading role in the founding of the Sheridan Park Research Community. As in 1928--when ORF was founded--Canadian industry and the Ontario government shared the cost of new buildings in the park.

He explained that the foundation's clients--whether companies or government establishment --pay the full costs, including overhead and total building and equipment depreciation. All work is confidential and patent rights are assigned to the client. The nature of the work at

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the foundation is strictly applied research.

Mr. Stadelman said that, in general, only about 3 to 5 per cent of Canadian companies are large enough to maintain and support their own research and development organizations. Below a certain size companies could not afford to build and maintain private research laboratories. However, many of the smaller companies could afford to sponsor a research program to be carried out at a contract research organization.

About 20 to 25 per cent of the manufacturing firms in Canada accounting for about 85 per cent of manufacturing output relied upon such contract research facilities. But the foundation also served the needs of the other smaller companies in providing investigation of production problems, technical advisory services and technical information.

To operate such a contract research organization required a staff strongly oriented towards contract research, had to be scientifically competent, and be knowledgeable in all newer technology. It was certainly in the interest of the federal government that essential technological services be readily available...but the present $25,000 federal grant..is, to say the least, token support".

Dr. W.N. English, Head of the Division of Applied physics, British Columbia Research Council said their council's budget was just under $1 million a year. Of this about 60 per cent came from contract research and about 25 per cent from the BC government.

BC Research would welcome an integrated national plan for R & D. It was suggested such a plan "must use effectively the whole spectrum of scientific talent in Canada, from pure academic research through mission oriented basic research and applied research to development and innovation. Accountability "is the key to performance and efficiency". This meant that continued support depended on performance. To this end grants should be replaced by contracts, and a large fraction...of the basic research should be mission oriented.

The Council would also like to see the administration of research in Canada simplified. He called for mobilization of scientific resources "within the framework of a master plan drawn up by the federal government...to meet the great challenges of our time..."

Under questioning by the Committee, Dr. English said between 30 to 40 per cent of the income of the BC Research Council came from outside Canada in the last decade. This included the U.S., Europe, one contract from Russia and work for the UN in southeast Asia.

No. 51 - June 3rd, 1969

Three briefs are contained in this report..from the Human Resources Research Council of Alberta, the Canadian Teachers' Federation and the Canadian Council for Research in Education.

As. Dr. Gordon McIntosh, Co-Chairman, Research and Development studies, Human Resources Council of Alberta, noted this body is a crown agency. The Council was set up "to do or cause to have done research bearing on the development and conservation of human resources", in the province.

The organization is intended to supplement the research capability in the social sciences in the province and commissions scholars throughout Alberta to undertake studies deemed to have high priority. It operates a grants and aid program, and plans to mount an in-house research development capacility.

The Council plans "to have a significant involvement in educational research and development. But he described the council as "an interdisciplinary social science research group. Education was only one of the concerns, for the council also worked on urban studies, studies of poverty and studies of manpower planning and development.

.../11

It was hoped to mount programs in which the skills of economics, sociology, geography, psychology could be brought to bear on single problem areas.

The council was organized in two main areas--research and development studies and planning and policy studies. The first involved mounting of pilot projects before they found embodiment in legislation and in the planning of social agencies. The projects the council was now undertaking in the research and development studies area were almost exclusively in the field of education.

Dr. Harold Dyck, Chairman, Planning and policy studies, said the council was launching a series of projects in four areas. These involved the planning of human resource development programs, research programs on poverty, urban development and manpower development.

He elaborated on the poverty studies by indicating concern with the effectiveness of government programs in the field of delivery systems in education, health and welfare when it comes to dealing with the poor in our province. The council commissioned a series of 26 papers from about 40 professors to assess social opportunity in Alberta.

Norman M. Goble, Deputy Secretary-Treasurer, Canadian Teachers' Federation, stressed that science in any country was dependent on the quality of science education.

He referred to the problem of obsolesence of knowledge among science teachers, and the absence of appropriate courses, not only "refresher" courses but those that provided for "a strengthening of the relevant aspects of his knowledge".

The science teacher needed courses in universities "that will be a distillate of scientific discovery and new scientific knowledge...".

Secondly, the CTF questioned the reality of the distinction made between physical and human sciences. The whole history of science had been one of the transfer of disciplines from the "arts" to science. The "human sciences" had now reached the stage where they should be recognized as part of the world of science.

In particularly if recognition is given to education and its component human sciences as lying within the field of science, there is need, in the national Canadian interest, for the improvement first of all of facilities for active research.

The CTF brief also recommended that the present disparity between funds for research in the natural sciences and in the behavioural sciences be reduced, that federal funds for research in education be made available on a large scale "to the appropriate authorities".

It also urged federal support for development of a Canadian system for rapid dissemination of research information, and that the federal government promote and help finance regional centres for research and development in education.

No. 52 - June 4th, 1969

This report and the one following, contain 11 briefs of professional medical associations and societies. In this report are those of the Biological Council of Canada, the Canadian Society of Microbiologists, and the Canadian Biochemical Society.

In the brief of the Biological Council, it is noted that despite the scope and the social and economic importance of life science, it receives a much smaller proportion of the nation's research dollar than does physical science. Universities and government laboratories carry the major financial responsibility since industrial contributions to biological science are comparatively small.

In Canada life science receives only one-third of federal research funds while comparable federal agencies in the U.S. assign over half their funds to this field.

.../12

Intensification of effort is recommended in three broad areas: basic biology at all levels, medical and health science, and problems of environmental deterioration.

The BBC recommends that the Privy Council Committee for Scientific and Industrial Research become the political entity for formulating science policy and that its Chairman be a minister without other departmental responsibilities. It is suggested that an agency responsible for funding biological research be formed under NRC to avoid a proliferation of agencies.

Finally, a plea is made to include human resource development as an integral part of the planning for a comprehensive science policy.

The Canadian Society of Microbiologists is representative of various aspects of medical, agricultural and industrial microbiology.

The brief supports the thesis that the development of an overall and comphrensive science policy with a carefully designed and fully matured plan for securing national efficiency is essential to the development of Canada.

Other points made are that education in all its phases must be given high priority. The brief says that the universities must be properly articulated with other educational facilities within each province and provincial systems of education coordinated and organized into a workable national mechanism.

Government incentives for development of research activities by industry are also advocated..."with the objective of developing industrial processes of our own that would feed the Canadian economy". It is stated that intensive studies of the activities of microorganisms "will lead to the discovery of unique reactions with industrial and commercial applications".

Government support is advocated of a few specialized research institutes, and the brief outlines the development of a Canadian post-doctorate fellowship scheme. It is also suggested that consideration be given to supporting national scientific societies in their efforts to facilitate scientific communication between English and French speaking members.

The Canadian Biochemical Society in its brief says the healthy growth of biochemistry should be sustained to take full advantage of the unique opportunities now offered for significant advances in fundamental knowledge and its application.

Support "at adequate levels" is urged for competent biochemical research in all university departments. But fundamental, as well as applied research, should be supported in institutions other than universities.

Major industrial corporations with biochemical orientations should be encouraged to establish substantial research laboratories in Canada.

It is also stated that Science policy-makers should include scientists who "are directly involved in research, and national scientific societies should be consulted with regard to appointments to these bodies".

Speaking for the Biological Council of Canada, Dr. James F. Stevenson, President, told the committee that Canada faced urgent national problems in biology, food production, the control and adaptation of the environment and health with which biology was "personally" concerned.

A critical mass of scientists was needed who would stimulate one another and lead to a much better production of science...."

The importance of support and development of pure sciences was stressed so that

.../13

"there may be a pool of people and a pool of knowledge to solve ...applied problems".

Dr. A. D'Iorio, President of the Canadian Biochemical Society, enlarged upon the point in the society's brief about national laboratories. He said "maybe the form this national laboratory should take is not necessarily the one presently existing". Also, he said research institutes probably should be more decentralized that they are now.

Dr. D'Iorio re-interated that the society was strongly in favour of encouraging establishment of research laboratories from industry--mainly pharmaceutical industries which carried on "extremely large" endeavour in other countries.

While the society realized there should be some sort of structure within government to co-ordinate all research efforts, Dr.D'Iorio said "we like the diversity of agencies that are funding research.

No. 53 - June 4th, 1969

A recurrent theme throughout the eight briefs following is that the federal government should increase its financial support for medical research. Thus, the Association of Canadian Medical Colleges expresses concern "that an inadequate rate of expansion of funds available to the Medical Research Council for support of scientific research will interfere with the recruitment and maintenance of academic staff at the universities and indirectly affect the quality of educational programs for the health professions, as well as reducing the likelihood of early application of scientific advances to the delivery of health care".

In addition to asking for expansion of funds made available to MRC, this association called for "a predictable, longer range policy on financial support...to permit rational planning and to develop the most advantageous balance in the commitment of available resources to fundamental, applied, operational and developmental research".

The other organizations presenting briefs at this hearing were The Royal College of Physicians and Surgeons of Canada, the Canadian Society of Immunology, the Canadian Society for Clinical investigation, The Canadian Physiological Society, The National Cancer Institute of Canada, the Council of the Canadian Association of Anatomists, and the Association of Chairmen of Canadian Departments of Pathology (medical schools of Canada).

The Royal College of Physicians and Surgeons is concerned with the establishment of standards for specialist training. It is not directly involved in medical research but is very much interested in this field because candidates for specialties have to be involved with research.

The brief besides stressing the importance of increased governmental support for medical research, asked that provision be made for "wide consultation by government on scientific policy".

Dr. B. Cinader, President, Canadian Society for Immunology, said the medical associations "want to see the original initiative lie with the research worker, who sees a plan and goes to the granting agency". After being evaluated by his peers, the research worker than receives research support. The society wanted to see this system continue.

The society would also like to see much greater emphasis on "group" support.. a group of investigators all with a common philosophy of approach, and supported by continuing guaranteed financing. Dr. Cinader said much greater support should be made available for this type of operation to the MRC.

Dr. Maurice LeClair, Vice-President of the Association of Canadian Medical Colleges, summarized the association's recommendations in their brief. The first was that no change in federal policy should be made which would weaken or interfere with the work of the Medical Research Council.

...'14

Secondly, a substantial expansion of federal support of medical science and "predictable longer range policy was asked.

Thirdly, that the federal government institute a policy to defray reasonable overhead costs.

Fourth, that the national role of the association should be recognized by solid long-term federal funding.

Dr. D. Wingle, councillor, Canadian Society for Clinical Investigations, summarized the main recommendations of his group. The first was that "hard and fast distinctions between (the various types of research carried on by the society's membership)...have little current relevance, for they are all required if the ultimate goal of health research is to be achieved..."

Secondly, the society asked for a long-term financial policy by the federal government to avoid the harmful effects of start-stop financing.

It was recommended that both levels of government make special arrangements to overcome lags and deficiences in health research in particular fields and centres, and provide for the needs of new institutions.

Finally, it was recommended that all those engaged in the field of health, recognize that consultation, co-operation and co-ordination were essential for achieving health goals in an effective way.

Dr. J.W. Pearce, President, presented the case for the Canadian Physiological society stressing that the weak link in present support of scientific activity in universities "is a failure to provide the academic scientist with enough uncommitted time to do quality work". Science policy could not be divorced from policy determining the support and evolution of places of higher education. It was envisaged that traditional science departments at universities might be divided into sub-departments of teaching, research and graduate training.

Also, the need for increasing independence of Canadian scientists in the field of scientific documentation be taken into account. Reviews, monographs and textbooks could be assisted by subsidization.

New support programs should be designed to ensure the growth of effective research environments in universities, without depriving the scientist of independence of initative.

The participation of faculties of graduate studies in any science policy formulation concerning development of more effective research environments within universities is emphasised. Most academic physiologists prefer to see special programs of support continue to be administered by the MRC or NRC, rather than support being made subject to value judgments increasingly based on pragmatic considerations.

Dr. D.H. Copp, President, National Cancer Institute, said voluntary support now provides about 90 per cent of the cost of the institute's work. The brief suggested that the amount of money contributed to the NCI and used for research should be matched percentage - wise by the government contribution; this support might start at 20 per cent.

Dr. Keith L. Moore, President, Canadian Association of Anatomists, said the association now has 237 members, mostly in the anatomy departments of medical, dental and veterinary medical schools. But there were also a number of anatomists in zoology and biology departments of universities and research institutes.

The main conclusions and recommendations in this associations brief were that funds be increased for provision of additional space for anatomical research in universities,

that special training grants be made by the MRC for the development of teacher-scientists, and that funds be increased for MRC and the NRC for this research.

Dr. Moore told the committee that "we feel that it would be better to improve research and teaching conditions in Canada" rather than spend funds on seeking to attract emigres to the U.S. back home.

Canadian Association of Pathologists, Dr. A.C. Ritchie, President said that the brief was being presented on behalf of the Association of Chairmen of Canadian University Departments of Pathology.

First, in considering the needs of pathology from the scientific point of view, it was necessary to consider the pathology departments' three functions-- clinical service to patients, teaching and research.

Secondly, the work of departments of pathology had grown greatly in recent years. It had also beem complicated by the introduction of many new methods of biological investigation. Pathology had not kept pace with the new demands.

Their principal challenge is to train specialists in pathology who would be able to serve the needs of a combined clinical teaching and research department.

The brief also advocated the establishment of regional laboratory services in Ontario, greatly expanded postgraduate training programs, and expansion in all departments.

Dr. John R. Evans, of the Association of Canadian Medical Colleges, agreed that the question of balance in medical research was very important. "we will have difficulty' if we divide money into very sharp missions and packages". Another aspect of balance, was the division of funds between fundamental research, applied research, operational research, and developmental research.

Dr. Evans also said that operational research "is very urgent and important". But there was a danger of "short-changing" the next generation if too much were spent on operational research and not enough on fundamental research.

Dr. G. Malcolm Brown, Chairman, Medical Research Council, undertook to clarify the question of how much was being spent by the federal government on medical research. In 1968-69 total funds available for Canadian medical research were about $44 million; MRC's component of this was $27 million.

For 1969-70, Dr. Brown said MRC's budget was increased 12 per cent. Yet the council was able to make awards for only 33 per cent of all new proposals, including all those from new faculty members.

No. 54 - June 5th, 1969
Royal Society of Canada

Founded in 1882 by a group of Canadian scholars in Montreal, "to promote in every practicable way, the Arts, Literature and Science, for the best interests of Canada". As Dr. C.E. Dolman, President, told the committee the RSC today represents all aspects of learning and scholarship in the country.

The society comprises three sections, of which Section III, with a membership of about 465 fellows represents the natural sciences. This section is patterned on the Royal society of London.

Dr. Dolman said there was a need among the learned societies for some body to co-ordinate their separate efforts. Given "a better financial situation than we can at present command..." the society could "offer leadership and spokesmanship to these other learned societies."

.../16

A prime objective of national science policy should be to ensure that first-rate post-graduate training facilities and challenging employment opportunities are available within Canada. A co-ordinating agency was recommended to review the increased numbers of graduate students undergoing university training in the various fields of science and engineering.

Canadian industries should offer more attractive employment inducements to Ph.D. graduates.

The growth of a large, bureaucratic science policy apparatus within the government was undesirable. The Science Council of Canada "should be closely concerned with decision-making...", and should make known its views on national science policy to the responsible ministers. The Chairmanship of the council should be a full-time employment, tenable for at least five to six years.

The present composition of the Science Council lacked representation from certain important fields of applied science-- i.e. the social sciences dealing with public health, food technology, and communication.

The humanities and social sciences be given research grants tenable at Canadian universities, comparable to those awarded in the natural sciences by NRC.

Development grants were recommended to universities to enable them to overcome deficiencies in library resources in the humanities and social sciences--particularly in French Canada.

There was need for a central secretariat in Ottawa for the learned societies. Also the aims of these bodies should be clarified and their activities co-ordinated. But the RSC did not advocate any radical changes be made in the organization of the many national institutions concerned with research in the humanities and social sciences.

No. 55 - June 5th, 1969
Chemical Institute of Canada

The government should create a National Science Foundation which would co-ordinate support on all matters touching on maintenance of supply and upgrading of competence of technically-trained people. That government research information services be greatly expanded to make quickly available scientific information to working scientists. That the government financially support approved national scientific associations, particularly in the field of publications and tours of distinguished scientific lecturers.

That the government consider contracting out research projects of national importance to collective groups from universities, government agencies and industry according to their abilities, thereby evolving diversified teams to better solve the nation's scientific problems.

That the government, as additional incentive for industrial research, include the freedom from tax of patent royalty receipts.

That the government consider the effect of the country's economic environment on the exploitation of new knowledge, and where possible take steps to improve this environment.

In summary, the institute's brief said that while the government did provide support for higher education through federal grants to universities, and N.R.C. did provide an increasing measure of support for scientific research and for the support of graduate students, the program was far from adequate to meet the needs of science education.

"A national science policy which will result in the provision of substantial financial aid being made available to meet all the needs of science education including the training of science and mathematics teachers at all levels of education, and the support of studies

.../17

directed towards the improvement of science education, should be developed."

The Canadian Association of Physicists in their brief made three main recommendations. These were: that in developing a national science policy the need for effective communication between scientists, government and the public be given the highest priority. That in consideration of its social, economic and cultural benefits, physics research in Canada should be supported in accordance with the general recommendations of the CAP survey.

That emphasis be given in educational institutions and in government and industrial organizations to the value of a physics training for the non-specialists, particularly those who eventually become concerned with innovation, production and marketing in the science-based industries.

The CAP survey made eight general recommendations for the orientation of government policy on physics over a five-year period. These dealt with strengthening research effort in applied physics; more prestige courses in universities with special options oriented towards applied physics and the interdisciplinary aspects of physics; continuing support of fields of physics "that are healthy at the moment", to greatly increase support for all forms of research in basic and applied physics related to conservation of natural resources. Maintaining at an adequate level and support for fields of research for which "our terrain and location give us a natural advantage", to set up joint institutes that will provide major facilities for use of several laboratories; to give sufficient support to theoretical physics in the broad sense to enable it to come into balance with experimental physics; and to continue to increase support for research in pure physics so that it will always form an adequate base for applied physics.

The CAP survey also dealt with the parameters of financial support for research in physics, and the roles in research of universities, industry and government laboratories.

The brief of the Chemical Institute of Canada was outlined by Dr. Norman S. Grace, President, while the presentation for the Canadian Association of Physicists was made by Dr. Morell Bachynski, President.

Dr. Bachynski said that in a recent attempt by the National Inventors' Council of the U.S. to identify the top 10 technological inventions of the past 20 years, the contenders included the transistor, the laser, holography, integrated circuits, color television, fibre optics, satellites and rockets. All of these depended heavily on physics during their inception and development.

To achieve the objectives set out in the CAP survey (outlined above), it was recommended that the average annual increase in the support of physics research by 23 per cent per annum over the next five years. This would be made up of a 25 per cent annual increase to the universities, a 15 per cent annual increase to government laboratories, and a 44 per cent annual increase in support of research in industry. Consistent with this federal government grants would have to be increased at an annual rate of 36 per cent over the next five years.

NO. 56 -
Brief by the National Committee of Deans of Engineering and Applied Science.

It is now imperative that engineering be recognized as a distince entity, and not as a branch of the sciences. Priority must be given to fields that contribute to the solution of a pressing human need, and will always refer to applied research or development. It is urgent that experts be assembled to identify the centre of activity for attacking these priority problems. The decisions should be based upon people, rather than facilities, with the result that an "institute" might embody efforts from several universities or research organizations.

There should be a broader base of sponsorship of university research. Some way must be found for stimulating Canadian industrial research and development. One method might

.../18

be to subsidize the employment of Ph.D. engineers.

The federal policy on estate taxes encourages the sale of family-owned Canadian industries to foreign purchasers.

Brief by the Association of Consulting Engineers of Canada

There is a need for an inter-disciplinary approach to our methods of tackling major problems such as transportation, urban development and water resources.

In addition there needs to be an inter-organizational approach. Many projects in which we ask for foreign help could well be managed by Canadians.

Research and Development capabilities are needed in Canada on a "floating" basis. Many of our large industries are subsidiaries of foreign firms who depend on their head offices for research and development. Smaller firms who cannot afford in-house research and development capacilities thus have difficulty in competing. They could effectively utilize the services of a pool of research and development specialists.

The export of Canadian products follows when Canadian consulting engineers are employed on foreign projects. They specify the materials that they know, providing a valuable way to introduce Canadian products into world markets.

We now have skills in a great many of the industrial and governmental endeavors in Canada, although there are some notable exceptions such as the petro-chemical industry. Such exceptions are unfortunate and deprive Canada of the technical resources to innovate.

Brief from the Association of Professional Engineers of the Province of Manitoba.

The key to a strong national technical capability is the development of self-generating regional technical communities.

Brief by the Engineering Institute of Canada

Two major National Objectives be implemented, one in Computer Technology , one in Transportation.

The Transportation Project to include: Special purpose aircraft, service industry applications(expanded containerization, etc.) resource industry applications (solids pipelining, etc), electric power transmission (superconductivity, etc) construction industry applications, the ice problem, nothern development (permafrost treatment, muskeg, canaling,etc.)

The Computer Technology Project be set with emphasis on the man-machine interface and software side; education and service industry applications, communication, health service, resource industry and construction industry applications.

Legislation be enacted to promote the formation of a Canadian Geoscience Data Institute, owned and operated by industry.

A Small Inventors Act be enacted to support the small or private inventor-entrepreneur, on a guaranteed loan basis.

A three year tax abatement be allowed on profits from manufacturing discoveries invented and worked in Canada, analogous to that allowed for Canadian geological discoveries.

The work required to accomplish the National Objectives be carried out by Industry on a contract basis.

Amplification on the briefs at the Hearing

While Canadian science is topical, and reflects global progress as in science, Canadian engineering is considerably out of phase with other developed nations. Secondary industry in Canada is about 12 years behind the United States.

There are another 50 consulting engineering firms in Canada doing work abroad, but competition is extremely fierce in many countries, including France, West Germany, and particularly Italy. They are subsidizing engineering studies abroad to a great degree so that they can get their foot in the door.

Some of the universities have formed industrial research institutes. These are proving to be a very effective way of entering into communication with industry. So when small industries in Canada avail of these facilities, they will show a big gain. The small industries do not have the spectrum of talent necessary for broad innovative activity.

If a Ph.D. is a measure of innovation, 70 per cent of the Ph.D.'s in this country are located in the universities. It is a relatively new task force. It is of relatively recent origin. In assembling task forces of this size so quickly, we have in the universities of Canada a group of people who have relatively short industrial experience.

Taking the Canadian transportation problem, there are already at least six agencies at various levels of government declaring their involvement, irrespective of their qualifications for the job. Herein lie the seeds of mediocity - too many uncoordinated and relatively unsophisitcated research designs.

Canadian management has been astonishingly slow to read the lessons about industrial research and development. The average American has almost two years more education than the Canadian. This does not mean that management is incompetent; it just means it is not as effectively trained at the moment.

There seems to be two views expressed about the Department of Industry, Trade and Commerce programs such as PAIT, IRDIA, DIPP and so on. The dissatisfaction stems not so much from the policy as from the execution of it. The industry's long waits for rebates on some of the Department of Industry, Trade and Commerce support programs seems to be the prevalent source of dissatisfaction. Whereas, the Industrial Research Assistance Program of the NRC, is instantaneous and it seems to generate a lot more enthusiasm.

To expand a little bit on this question about management. We make a suggestion that will be tried out next year. It dealt with what our problem is in order to get innovative activity into Canadian industry. We have to convince two jurisdictions and perhaps three that it is a good thing. We have to convince a Ph.D. that he can contribute to industry in ways other than research in his own narrow line of endeavour. Then you have to convince the university that this man should be broad enough in his abilities to assist industry in a broader spectrum than his own narrow thesis. Then you have to convince industry that a man who has come out of a Ph.D. program can in fact interact with his industry profitably to show a profit. None of these three groups is really convinced of this fact, and in order to get the show on the road we are suggesting that post-doctorate fellows should be encouraged to carry their fellowships not to another graduate school but to industry with federal support. This is the only place where we suggest that money should be spent in this area. This is now under consideration by the National Research Council.

The big problem is that the science community itself has not developed some kind of mechanism that will provide a vehicle for the input of the views of the science community into national science policy decisions.

The science community, including the engineers, will have to work out some kind of channel by which they can make a representation to the Government in a more orderly way than has been the case up to the present.

... '20

No. 57

Brief of Canadian Economic Association

There is a major national interest in the development and supplying of outstanding economic researchers in Canada, pure, applied and historical in their orientation.

Financial support for graduate studies could be made more effective. There is a need to attract established economists of proven outstanding ability and young scholars of outstanding potential. We refer to research professorships and the need for a central research bureau.

While there are over 400 economists resident in Canadian universities (and perhaps another 200 in business and government employment) neither their average professional quality nor their number is yet adequate to satisfy current Canadian requirements.

No. 58 - June 10th, 1969

CANADIAN POLITICAL SCIENCE ASSOCIATION (D.V. Verney et al)

There is a relatively underdeveloped field and will require considerable financing to overcome this. CPSA is content that Canada Council remains the chief granting agency.

CANADIAN HISTORICAL ASSOCIATION (F. Ouellet)

Would like to see: support for microfilming of European records relevant to Canada; and extension of aid to learned journals.

HUMANITIES RESEARCH COUNCIL OF CANADA (P.B. Waite et al)

Establish a national information retrieval system centered on Canada libraries. Input for a Science Policy should give due weight to the contributions that humanists can make.

CLASSICAL ASSOCIATION OF CANADA (C.M. Wells)

Need more funds for museums, for facilities for field training in archeology, and greater research resources.

ASSOCIATION OF CANADIAN UNIVERSITY TEACHERS OF ENGLISH (R. Wiles)

Science policy should include a concern for adequate support of research in English literature and language.

No. 59 - June 11th, 1969

CANADIAN CONSTRUCTION ASSOCIATION (M. Stein et al)

Study the conversion to metric system. Carry out more research in education and training, labor relations, business practices, economics and statistics, technological research and planning. Establish a construction industry development fund for R & D.

CANADIAN INSTITUTE OF STEEL CONSTRUCTION (R.G. Johnson et al)

PAIT repayment requirement be revised to reward success as well as subsidizing the risk of failure. Increase number of industry representatives on Science Council and NRC.

CANADIAN TRUCKING ASSOCIATIONS, INC.

Amend IRDIA to permit grants to associations. Encourage universities to assist industry to carry out research projects.

.../21

No. 60 - June 11th, 1969

CANADIAN PSYCHIATRIC ASSOCIATION (R.A. Cleghorn)

Need more adequate scholarships, more emphasis on study of alcohol and drug addiction and forensic psychiatry.

CANADIAN MENTAL HEALTH ASSOCIATION (J.D. Griffin)

Immediate emphasis is required on studies in clinical and preventive aspects of psychiatry and in the behavorial sciences related to mental illness and health.

No. 61 - June 12th, 1969

PROVINCE OF MANITOBA DEPARTMENT OF INDUSTRY AND COMMERCE (S. Spivak et al)

Expand applied research and stimulate innovation. Select carefully research goals for maximum industrial yield. Don't limit R & D programs to large companies and sophisticated products. Centres of excellence should be coordinated with regional development policy.

CANADIAN LABOUR CONGRESS (A. Andras et al)

Include social sciences in the articulation of a science policy. Favors clothing science policy in a cloak of social morality.

AGRICULTURAL INSTITUTE OF CANADA (E. Biggs et al)

Ag. research should continue to be problem oriented. University Ag. research should be more generously supported. Increase substantially funds for research in Ag. economics and Ag. engineering.

No. 62 - June 12th, 1969

ARCTIC INSTITUTE OF NORTH AMERICA (T. Lloyd et al)

Science policy should include the realization of the full social and economic potential of the North as a national goal. Govt. should provide operating grants to non-profit research institutions to sustain their growth at a rate commensurate with their role in the total research spectrum.

MINING ASSOCIATION OF CANADA (J.L. Bonus et al)

Mining industry needs imporved mineral locating sensors,new methods for primary excavation of rock and ore, methods to improve mining environment and the maximum beneficiation of ore, more efficient metals recovery processes, improved transportation, development of automation.

CANADIAN COUNCIL ON URBAN AND REGIONAL RESEARCH (J.M. Martin et al)

Spending on fundamental urban studies should rise in the next few years to two or three times the present annual rate.

No. 63 - June 13th, 1969

CANADIAN CHEMICAL PRODUCERS' ASSOC. (B.B. Hillary et al)

Improve the industry's economic environment and technical information services. Encourage import of foreign technology and the export of Canada's technology. Grants for research should not be tied exclusively to increments in research carried out by companies. Award government research contracts to industry. Survey university graduations and industry's

... '22

manpower requirements. Retain present legislation on patents and trade marks.

MACHINERY AND EQUIPMENT MANUFACTURERS' ASSOC. (C.A. Peck)

Expand direct R & D aid to industry. Many R & D projects should be considered on their own merits and assistance made available without reference to 5 year averages or other restrictions.

CANADIAN PULP AND PAPER ASSOCIATION; PULP AND PAPER RESEARCH INSTITUTE OF CANADA (R.M. Fowler; P.R. Gendron)

Greater consultation between govt. and industry on R & D requirements of industry, the priorities. Study whether govt. R & D activities reflect an adequate concern with the potential economic benefit of research to the economy. More Govt. R & D done in industry.

PHARMACEUTICAL MANUFACTURERS ASSOCIATION OF CANADA (W. Wigle et al)

Recognize the value of the Patent Act in creating proper incentive and environment for R & D. Tariffs for scientific equipment and chemicals used in research, but not made in Canada, be eliminated. Govt. R & D assistance should be a tax allowance with carry forward to future years. Pharmaceutical manufacturers in Canada should not be discriminated against by encouraging importers. Recognize that only to the extent that patent protection permits, will publication of research findings by scientists continue to be a tool in retaining scientists in Canada.

CANADIAN ELECTRICAL MANUFACTURERS' ASSOC. (K.H. Ramsey et al)

Suggested several modifications to the IRDIA program.

ELECTRONIC INDUSTRIES ASSOC. (L. Balcer et al)

Granting agencies should give special encouragement for unique products.

No. 64 - June 17th, 1969

CANADIAN STANDARDS ASSOC. (J.H. Jenkins et al)

Standardization must be developed on a voluntary basis, and practiced on the basis of minimum requirements consistent with sound industrial practice.

PATENT AND TRADEMARK INSTITUTE OF CANADA (R.S. Smart et al)

A strong patent system is of prime importance in expansion of industry and industrial research. Effectiveness of present patent system is not as great as it should and could be. Among several changes to this system recommended were: increased funds and adopt electronic data retrieval techniques in patent office. Remove the need for legislative power in respect of patents to be used to control undesirable trade practices.

NATIONAL DESIGN COUNCIL (J.C. Parkin et al)

More emphasis on research on relationship of man to machine, systems and environment. More positive provision be made in support of industrial design in govt. incentive programs. Make good industrial design practice mandatory in formulating and developing govt. standards, procurement and public works policies and activities.

No. 65 - June 17th, 1969

DU PONT OF CANADA LIMITED, MONTREAL (F.S. Capon et al)

Government's paramount contribution to industrial research is to provide a framework

of fiscal, monetary and trade policies which will enable the most productive manufacturing industries to prosper. Incentive programs should contemplate the free flow of information across borders under normal commercial conditions.

CANADIAN INDUSTRIES LIMITED, MONTREAL (L. Hynes)

Greater coordination of a wide range of government actions is needed for successful R & D programs. Some of these areas for coordination include policies on patents, combines, tariffs and taxes.

DUNLOP CANADA LIMITED, WHITBY (S.B. Kerr et al)

Present incentive plans, particularly PAIT and IRDIA, are not structured to operate across all industrial segments where it would be useful to increase R&D.

GULF OIL CANADA LIMITED, Toronto and Montreal(H.S. Sutherland)
and SHAWINIGAN CHEMICALS DIVISION, Montreal (V.N. Hurd)

Government's internal and external research expenditures should be coordinated, and periodically assessed for usefulness. Greatly expand government information services. Government should contract research projects of national importance to collective groups.

O.H. JOHNS GLASS COMPANY LIMITED, Toronto (J.P. Richards)

Establishment of a scientific apparatus manufacturing industry here nearly equals in importance the encouragement of institutional research in Canada. Tariff protection should be provided for goods of a class or kind manufactured in Canada to encourage growth in this industry here.

UNIROYAL LIMITED, Guelph (J.C.R. Warren)

Government should suggest national goals. Industry should develop the ability to pin-point and define needs it is capable of supplying in both national and international markets. Applied research in universities and in NRC must be increased and related to industry. A science policy must also consider how science impinges on the national life.

No. 66 - June 18th, 1969

MERCK FROSST LABORATORIES, MONTREAL (R.S. Stuart et al)

Within the overall objectives of a national science policy:-

- government should set goals, use contract research, create sophisticated research groups, provide tax incentives.
- university should expand research areas of excellence, collaborate with other sectors, include teaching in techniques.
- industry should form groups of skilled research teams for viable research, collaborate with government and university, strive for balanced programs.

No. 67 - June 18th, 1969

CHEVRON STANDARD LIMITED (G.L. Henderson)

The incentives programs should be extended to companies incorporated outside Canada but carrying on business within Canada.

.../24

SYNCRUDE CANADA LIMITED, EDMONTON (S. Stewart)

Climate for development work should be improved by government research on ways to overcome problems of distance, weather and terrain. The sociological and ecological obstacles to resource development should be under continual research.

SHELL CANADA LIMITED, TORONTO (G. Shane et al)

Make greater efforts to support research in industry as against government in-house programs. Contract out to industry of government sponsored research.

IMPERIAL OIL LIMITED, TORONTO (J. Cogan et al)

Establish and maintain institutes oriented to specific missions, or set up to provide exceptionally high cost facilities for common use. Criteria for the allocation of government research funds will be largely determined by the requirements of recognized national objectives. Industry should employ more professors as consultants.

No. 68 - June 19th, 1969

NORTHERN ELECTRIC CO. LTD. MONTREAL (V.O. Marquex et al)

Must encourage innovation and entrepreneurship. Must establish national priorities by using social science research to evaluate human wants. Continuous dialoge needed between the 3 sectors.

E.M.I. ELECTRONICS CANADA LIMITED, Montreal (J.B. Starkey).

Fully funded contracts offer a more economical method for boosting R &D effort than government grants.

CANADIAN WESTINGHOUSE CO. LTD., HAMILTON (W.J. Cheesman)

Recommends levelling off of in-house government and university expenditures for research in physical sciences and increased emphasis on quality. Pay attention to the supply of production-oriented engineers.

RCA LIMITED, MONTREAL

Revise incentive plans for more effectiveness. A government commitment of priorities and initiation of mission oriented projects would develop an improved scientific and technological base in industry.

No. 69 - June 19th, 1969

CHEMCELL LIMITED, MONTREAL (J.C. Clunie et al)

There should be a simple incentive scheme for R & D in selected industries. It should be in the form of annual grants equal to 25% of all R & D capital and current expense outlays for that year. The present Canada Only restrictions on research exploitation be minimized. There should be an investment tax credit on new production facilities.

MACMILLAN BLOEDEL LIMITED, VANCOUVER (L.A. Cox)

Recommended various modifications to the incentive programs. Give for a limited time a tax holiday to Canadian companies who have discovered and patented in Canada successful R & D work that will lead to new jobs etc. Establish at NRC a national technology bank. Federal government should establish a contract research system similar to U.S., coordinated by NRC.

.../25

ABITIBI PAPER COMPANY LIMITED, TORONTO (R.M. Dorland)

Exploitation of research results needs encouragement. IRA-NRC grants programs should be continued. IRDIA's principle of a base expenditure should be eliminated.

No. 70 - June 20th, 1969

ORENDA LIMITED, (F.P. Mitchell et al)

Military expenditures should be channeled into industry. Government cost sharing programs and tax incentives should be increased. Government funding of R & D in-house and in universities should be measured as to its usefulness to industry. Encourage flow of U.S. capital. Encourage trend to reduced tariffs so industry can develop a broader base to support R & D.

COMPUTING DEVICES OF CANADA LIMITED, Ottawa (J.F. Taylor et al)

Allocate priorities for total funds for R & D so that the percentages of the total are proportional to the desired impact on the country's growth, GNP and social problems.

LITTON SYSTEMS (CANADA) LIMITED (J.D. Freitag et al)

Government must create a climate of opportunity in order to encourage R&D. Basic research should be allocated up to 5%, applied research 10% to 20%, and remainder to development.

No. 71 - June 24th, 1969

DOMINION FOUNDRIES AND STEEL LIMITED, HAMILTON (A.D. Laing et al)

Federal incentives could be broadened to include development work for improving processes. In R & D support, emphasis should be placed on support to projects to increase secondary manufacturing. University scientific personnel must be exposed to industrial dollar and cents thinking. University graduates need improvement in communications, problem-solving, economic realities.

STEEL COMPANY OF CANADA LIMITED, HAMILTON (A.D. Fisher et al)

Government incentive programs should take the form of tax concessions rather than grants or subsidies. Tax incentives should apply to all R & D expenses and not merely the excess over some base period. Administration of incentives programs should be centralized. Establishment of government-sponsored industry-wide research associations is not recommended.

ALUMINUM COMPANY OF CANADA LIMITED, MONTREAL (G.M. Mason et al)

Establish a coordinating authority for Canada's research community. This would have a permanent advisory committee to review adequacy, set goals, encourage innovation. Use a computerized information retrieval system. Lower the national investment in basic research and correspondingly increase the applied and developmental research.

No. 72 - June 24th, 1969

BOBTEX CORP. LIMITED, MONTREAL (E and A.J. Bobkowicz)

Canada can acquire the technical competence to create and support a healthy secondary industry based on innovation by incentives: (a) create a government sponsored insurance plan to cover 75-85% of the risk in the "idea to hardware" development phase of inventions; (b) have a income tax credit plan for industries making new products based on new technology and particularly export-oriented.

.../26

AIR INDUSTRIES ASSOCIATION OF CANADA, OTTAWA (D.A. Golden et al)

Serious consideration should be given to expand current government R & D assistance, by increasing the level of financial support for projects that lead to development of internationally competitive products.

UNITED AIRCRAFT OF CANADA LIMITED, MONTREAL (T.E. Stephenson)

Effective exploitation of development projects is best undertaken by industry; Government support to development can result in beneficial effects on employment, balance of payments, and technological capabilities.

No. 73 - June 25th, 1969

QUEBEC HYDRO ELECTRIC COMMISSION, MONTREAL (L. Boulet)

Electrical energy in Canada will experience the highest growth rate of any form of energy between now and 1980. To facilitate development of Canada's electrical industry, the federal government should participate in establishing an electrical research institute, and should provide grants for its research program. The most promising research related to new powerhouses lies not only in hydraulic generation, nuclear and conventional thermal power stations but also in fast breeder reactors. Thermofusion is a subject for long term research. Federal government should subsidize research on the applications of electricity.

No. 74 - June 25th, 1969

BELL CANADA, MONTREAL (A.G. Lester)

Greater use should be made of joint govt.-industry task forces to study technical problems. Each operating govt. dept. should have a knowledgeable staff in planning and technological R & D so they can deal with industry on issues within their responsibility. Continue incentive grants for industrial R & D but provide better terms for companies having a high level of R & D without a spectacular annual increase in R & D expenditures. Revise the combines legislation to encourage large corporate entities which have sufficient resources to complete internationally. Federal govt. should support a major national R & D effort to ensure that Canada's technology in micro-miniaturization of electronic circuitry is kept at a high level.

JOHN LABATT LIMITED, LONDON, ONTARIO. (J.D. Cronyn et al)

Our science policy should include continuing short term innovative work to commercialize the results of R & D, and long term work to greater use of our resources. The Policy should assure maximum use of inventions made by others. Federal research bodies in a common field should be combined. Federal regulatory bodies should do a state-of-the-art review regularly to bring regulations into line with advances.

No. 75 - June 26th, 1969

Mabel F. Timlin, Emeritus Professor of Economics, Univ. of Saskatchewan, Saskatoon

Decision-making by govt. in the human area must be backed by basic knowledge and much of this will be gained by multi-disciplinary research and some by cross-disciplinary research involving natural and social sciences.

R.E. English, Professor of Economics, Carleton University, Ottawa

Called for rationalization of arrangements for economic research by, or supported by, federal government. This could greatly increase effectiveness of resources allocated to economic research in Canada.

.../27

J. Lukasiewicz, Associate Dean for Research, Virginia Polytechnic Institute, Blacksburg,Va.

Canadian R & D should change emphasis from basic to developmental effort, and from performance by government to performance by industry. Gradually transform NRC into a graduate school of science and engineering. Give high priority to research aimed at increasing productivity in Canada and deemphasize military R & D. A massive effort is required to prevent the appearance of the detrimental effects of high technology. A new department of environmental control should be created.

F. Eric Burke, Department of Management Sciences, University of Waterloo, Waterloo, Ontario.

Encourage long term innovative behaviour in conjunction with imported technology and policy changes by specific granting mechanisms.

J. Mardon, Vancouver and J. Root, Toronto

Raise the level of research management. We are educating our scientists and technologists for an unreal, not a real world; this is most evident in the PhD cycle. Study periods should be encouraged for engineers to refurbish their technical competence. Canadian university grads do not easily assimilate into industry and training schemes to facilitate this transfer should be set up. There are few women scientists and engineers and this is awaste of brains to the nation.

No. 76 - June 26th, 1969

ROYAL ARCHITECTURAL INSTITUTE OF CANADA (T. Howarth)

Government should investigate the establishing of an interdisciplinary program of environmental studies. Task forces to advise this committee should be set up on a regional basis. One of the first jobs should be to assess the research potential of universities with view to establish centres for such work. Architecture should be recognized as one of the basic disciplines relating to environmental studies.

CANADAIR LIMITED, MONTREAL (R.J. Ross et al)

Government assistance should be increased to permit including most of the elements of the cost of new product development and the repayment requirement should be modified to give industry the option of reinvesting such funds in further new product work. The Industrial R & D Act should allow some of the base period expenditures as well as additional expenditures.

J.P.I. TYAS, Office of Science and Technology,Dept. of Industry,Trade & Commerce, Ottawa

The Author summarized the conclusions of the 8-volume report on "Scientific and Technical Information"; prepared by the Department.

No. 77 -- June 27th, 1969

THE SHERIDAN PARK ASSOCIATION, Sheridan Park, Ontario. (N.S. Grace et al)

Improvements in federal aid programs suggested:- (a) the number of government agencies administering assistance programs should be reduced to one; (b) a program based on a percentage of expenditures would be more effective and more equitable; (c) the restrictions in some programs about sub-contracting research to outside organizations and the exclusion from all programs of support for market research should be removed; (d) Government support of industrial research must be greatly expanded.

The above concludes the Synopsis of the Briefs presented publicly.